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LAND SYSTEMS AND PASTURE TYPES OF THE SOUTHERN ALICE SPRINGS DISTRICT

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SUSTAINABLE AGRICULTURE

THE DEPARTMENT OF PRIMARY INDUSTRY AND FISHERIES IS COMMITTED TO THE PRINCIPLES AND PRACTICES OF SUSTAINABLE AGRICULTURE

Definition:

Sustainable agriculture is the use of practices and systems which maintain or enhance:

- the economic viability of agricultural production;
- the natural resource base; and
- other ecosystems which are influenced by agricultural activities.

Principles:

1. Agricultural productivity is sustained or enhanced over the long term.
2. Adverse impacts on the natural resource base of agricultural and associated ecosystems are ameliorated, minimised or avoided.
3. Harmful residues resulting from the use of chemicals for agriculture are minimised.
4. The nett social benefit (in both dollar and non-dollar terms) derived from agriculture is maximised.
5. Agricultural systems are sufficiently flexible to manage risks associated with the vagaries of climate and markets.

DEPARTMENT OF PRIMARY INDUSTRY AND FISHERIES

LAND SYSTEMS AND PASTURES TYPES OF THE SOUTHERN ALICE SPRINGS DISTRICT

BY KEN SHAW AND GARY BASTIN
RANGELAND PRODUCTION AGRONOMISTS, ALICE SPRINGS

LAND SYSTEMS AND PASTURE TYPES OF THE SOUTHERN ALICE SPRINGS DISTRICT

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LAND SYSTEMS AND PASTURE TYPES OF THE SOUTHERN ALICE SPRINGS DISTRICT

INTRODUCTION

This bulletin describes the land systems and pastorally important land units found on cattle stations south of Alice Springs. A series of 5 full colour map sheets at a scale of 1:250,000 are available separately.* The area has previously been mapped to a scale of 1:1,000,000 by Perry et al., (1962) but in 1976, when Range Management studies commenced at the level of the individual land holding, remapping to a larger scale was found necessary.

The survey area extends over 43,000 km^2 on 15 pastoral leases between Alice Springs and the South Australian border (Figure 1).

Field work was conducted intermittently between 1977 and 1983.

LAND SYSTEMS

Land systems of the region (Perry et al., 1962) were used as the resource inventory unit. Christian and Stewart (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 on aerial photographs and forms a convenient mapping unit.

Land systems were delineated on 1:80,000 scale black and white aerial photography. Mapping accuracy was checked in the field and then transferred to 1:100,000 scale pastoral lease plans. These plans have been combined and further reduced to produce the 1:250,000 map series which supplement this publication (available separately).*

Thirty five land systems were mapped within the survey region. Since our work is pastoral industry based, 6 land systems were split into 2 or more major land units where these had both significantly different pastoral value, and form a manageable area. Perry et al.,(1962) provides a more detailed account of the geology, geomorphology and land units present on each land system.

Some of the Land System names adopted by Perry and used in this report, are similar to Pastoral Lease names used in the region. The reader should take care not to confuse a Land System name with a Pastoral Lease name.

Land systems are arranged according to their geomorphological affinities.

PASTURE TYPES

Land systems consist of a number of smaller land units and some land units are often common to several land systems. Where these land units are either important for beef cattle grazing or occupy extensive areas, they are called range types or "pasture types" (Bastin et al., 1983). This bulletin also describes the pastorally important pasture types encountered on each land system.

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* Mapsheets are available from the publication section DPI & F, PO Box 79, Berrimah NT 0828. Telephone (089) 221 313. Facsimile (089) 470749.

Classification into pasture types was undertaken on the basis of landform, soils and vegetation. Soil data collected included texture, colour, pH and presence of free carbonate. Landform was coded on the basis of land system and land unit descriptions described by Perry et al., (1962).

The vegetation described is that most likely to occur on areas in good range condition following summer rains. Local common plant names have been used throughout for simplicity and brevity. The associated scientific names are given in Appendix 1.

CURRENT RANGE CONDITION

A classification of Range Condition into "poor", "fair", "good", and "excellent" is included with the Land System descriptions. For the purposes of this Bulletin, Range Condition refers to the degree of change in pasture species composition due to the past effects of introduced livestock and feral animals, and follows the STARC method [Standards for testing and assessing range condition; (Lendon and Lamacraft, 1976]. The index obtained by this method was arbitarily adjusted downwards, where deleterious changes in tree and shrub layer or soil status were believed to have occurred. Allowances were made for recent grazing so that the assessment was not penalized for any short term utilization effects. Assessors underwent initial training by first estimating and then clipping and weighing the species' biomass on a number of sites. There is inherent subjectivity in this method, and it was used in the absence of a sufficiently precise, objective and more appropriate method at the time. Alternative multivariate methods for the analysis of vegetation and soil parameters are now being advocated, (Hacker, 1986) and have since been adopted by this Department.

While this "Range Condition" classification is primarily ecological, it can be expected to bear some relationship to the current ability of the country to sustain future cattle grazing.

The general characteristics of rangeland in different condition classes is given in Table 1.

SITE SELECTION FOR RANGE CONDITION ASSESSMENT

To obtain an appropriate assessment of range condition over broad areas, monitoring sites were located at between 3 and 4kms from waters in reasonably extensive areas of preferred pasture type (Foran, 1980). Sites were located adjacent to tracks for ease of relocation.
The rationale for selecting sites relates to the watering point being the focus for stock control and grazing management. Where pastures are relatively homogeneous, grazing pressure in extensive rangelands decreases with increasing distance from water (Lange, 1969). However, where there are mosaics of vegetation communities on offer to free ranging cattle, and differing states of vegetation maturity and abundance in each community, grazing pressure is seldom uniform at any given distance from water. Low et al., (1980) and Hodder and Low (1978) described a hierarchy of cattle grazing preference for several pasture types around Alice Springs which, by extrapolation, can be used to predict where the majority of cattle will choose to concentrate their grazing around each water. Under conditions of good and moderate feed supply and quality, this will be within 3 or 4kms of water. These factors were all taken into account when selecting sites.

A total of 220 sites were established on 11 stations in this manner between 1977 and 1979. The majority of these sites were reassessed in 1983. An additional station was surveyed in 1982 and 3 further stations surveyed in 1983 to give a total of 254 assessment sites over 15 stations.

Subjective assessment of range condition and land capability over the remainder of each station was gained through visual inspections along bore tracks. These assessments were recorded in note form.

RANGE CONDITION AND CATTLE PRODUCTIVITY

To date there have been no grazing trials in the region so a conclusive relationship between range condition and herd productivity has not been established.

No consistent differences were found in diet quality selected by cattle grazing open woodland, mulga annual and Mitchell grass plain pasture types in poor, fair or excellent condition NW of Alice Springs (Squires and Low, 1987). Similarly, Friedel (1981) was unable to show any relationship between pasture yield or pasture growth and assessed range condition at the same locations. Pasture production levels were near their maximum under favourable seasons and presumably, cattle were readily able to select a diet high in digestible energy (Wilson and Harrington, 1984). In the survey region, trends are expected to become apparent in drier years when the amount and palatability of pasture on poor condition areas would be reduced. However, animal performance invariably lags behind changes to the soil and vegetation resource and used alone, is a poor indicator of range condition (Smith, 1978).

GRAZING CAPACITY

Rainfall events in Central Australia are unpredictable and erratic, resulting in major variation between seasons and between years in the availability of forage for grazing stock. At Mt Ebenezer, an eleven fold difference, due to season in standing biomass on an ungrazed site has been recorded. Large species compositional changes also occur from year to year, with the percentage of grass varying between 28% and 87% at the same location between 1974 and 1976 (Bastin, 1982). The short term potential carrying capacity of any vegetation type thus varies tremendously from season to season.

Properties in the area are extensively managed, such that the land available to any group of stock at any time consists of a number of land units and/or pasture types of varying preference to them. These factors dictate that the allocation of a single Grazing Capacity figure to any land type is at best a very difficult and necessarily imprecise task. Nevertheless it is considered useful to provide an indicative figure for a 'normal' and a 'drought' situation for each Land System.

The values given were derived subjectively from observation through the district and are nominated on the basis of preserving vegetation and soil resources. Many pastoralists would regard them as being conservative. There is no experimental evidence in the area of a relationship between grazing pressure and cattle productivity.

MANAGEMENT HAZARDS

Notes are included about our perception of the effect of key components of Land Use (Grazing, Erosion, Feral Animals and Fire), on each Land System. The degree of hazard associated with each combination of Land System and Land Use is arbitarily classified as Low (Minor, Slight, Very Low), Moderate or High (Very High).

LAND USE

In the course of the survey, records were kept of the current land use, and our opinion of the most appropriate use for the various land types. This information is summarised and reported for each Land System. Opinions concerning the suitability of country for various types of land use will vary, and in addition for any particular pastoral lease, land use will be assigned on the basis of a number of factors specific to the enterprise including:-

- suitability of land type for a particular class of stock
- the relative numbers of stock of various types to be accommodated
- the mix of land types on the station
- the present level of paddocking for herd control
- the opportunity for future development

The information provided is thus only a general guide.

Table 1. CHARACTERISTICS OF PRODUCTIVE PASTURE TYPES IN DIFFERENT CONDITION CLASSES

Range Condition Class	Condition Score %	CHARACTERISTICS: Pasture Vigour & Species Composition	Erosion Hazard	Past Erosion	Potential Productivity: Normal Season	Potential Productivity: Drought Season
EXCELLENT	80-100	Palatable biennial grasses abundant and vigorous. Palatable perennial grasses common.	Low. Plant & litter cover provides adequate protection in most seasons.	Low	High	Fair. Perennial species provide some feed & are able to respond to storm rains. Topfeed accessible.
GOOD	60-79	Palatable annual grasses vigorous & dominant in pasture; some loss of palatable perennial grasses	Low. Hazard increased during drought due to some loss of perennial grass cover.	Low	High	Fair. Topfeed usually accessible. Butts of biennial grasses are able to respond to small falls of rain.
FAIR	40-59	Vigour of palatable annual grasses reduced; unpalatable forbs and grasses more prevalent, ephemerals dominant when seasonal conditions are favourable; increased abundance of unpalatable shrubs.	High. Reduced cover makes soil moderately susceptible in normal seasons and highly susceptible during drought.	Moderate. Soil loss due to past wind & water sheeting, drift or minor rilling evident.	Fair. Productivity reduced because lesser amount of palatable pasture is grown.	Low. Palatable herbage absent; pasture available only after rainfalls sufficient for seed germination & growth; topfeed browsed beyond reach.
POOR	20-39	Palatable annual grasses are sparse & lack vigour; ephemeral forbs or unpalatable species are dominant, unpalatable shrub density high; death of palatable trees & shrubs.	High. Soils highly susceptible to erosion at all times.	Extensive. Serious, widespread soil loss due to wind drift, scalding, rilling or gullying.	Low. Grazing restricted to short periods when herbage is available.	Negligible. Palatable herbage absent, topfeed either dead or browsed beyond reach.
VERY POOR	0-19	Ground largely bare. Dominance of unpalatable or ephemeral species.	High. Already extensively eroded but still susceptible.		Very Low.	

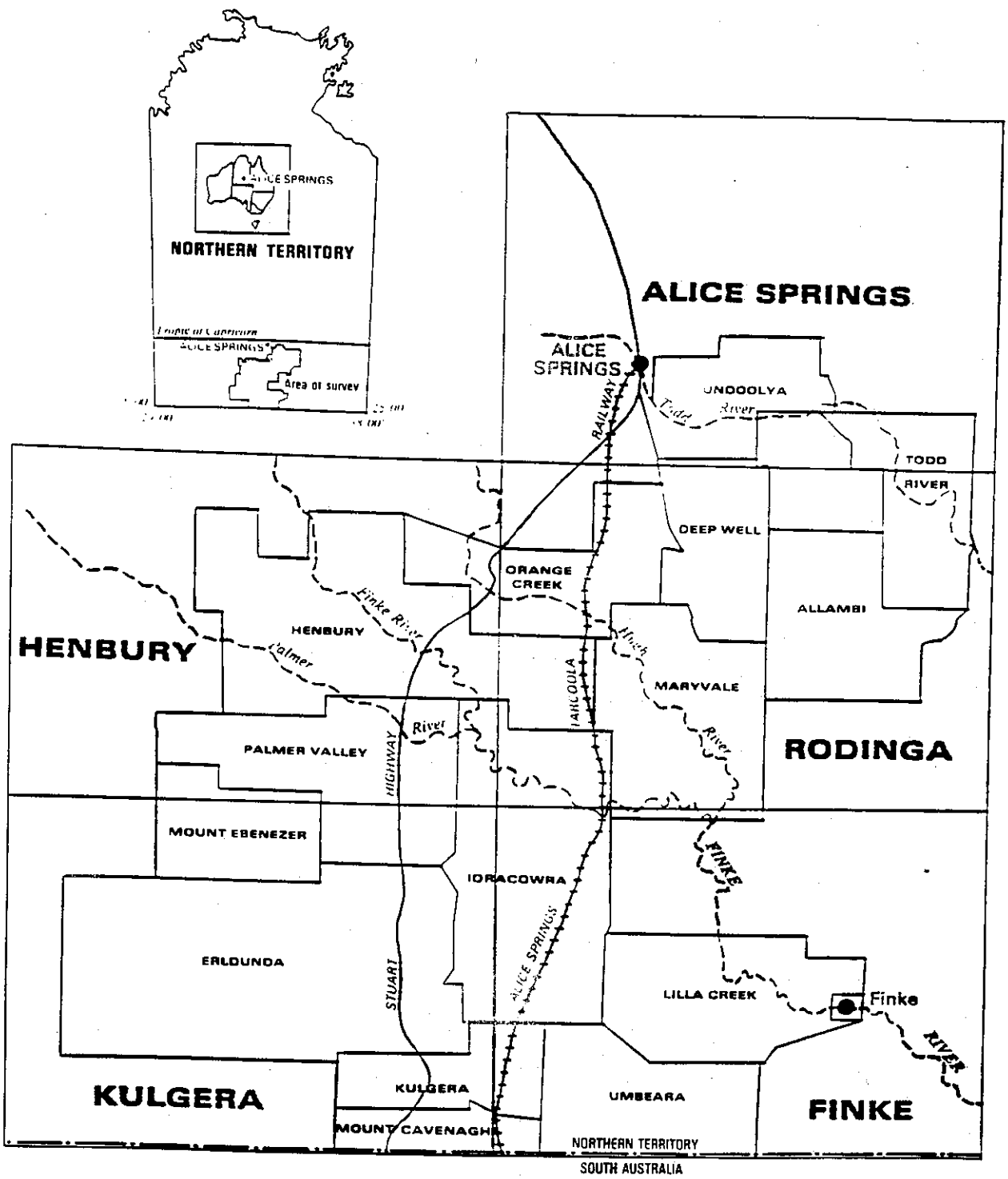
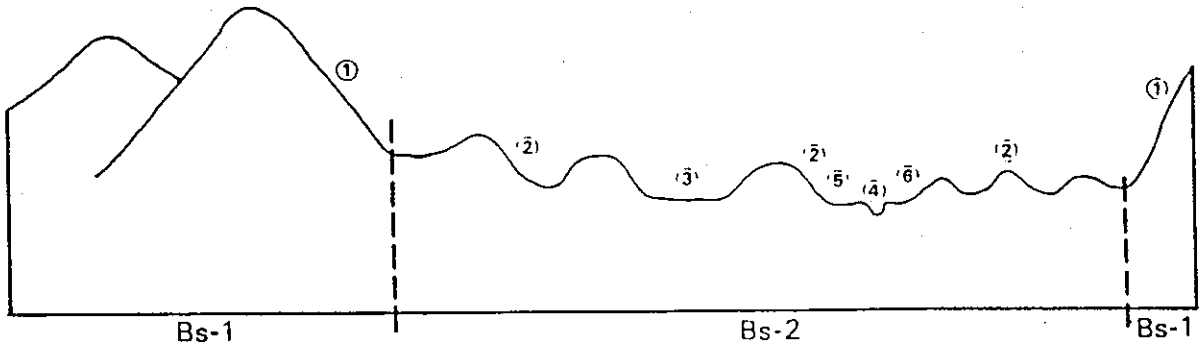


Figure 1. Locality map of the survey area.

BOND SPRINGS (Bs) LAND SYSTEM (248km²)

Bs-1 (178km²) Ridges and lower rocky foothill slopes of gneiss and schist.

Bs-2 (70km²) Low hills and narrow, undulating stony plains.



UNIT	PASTURE TYPE	EXTENT	LANDFORM	SOILS	VEGETATION
1 (Bs-1)	RIDGES & HIGH HILLS (Very low productivity)	Large	Rocky slopes and ridges	Bare rock with pockets of shallow, gritty soils.	Witchetty bush, scattered mulga and low shrubs over sparse mountain wandarrie and woollybutt wandarrie. Minor kangaroo grass, woollyoat grass and forbs.
2 (Bs-2)	SMALL HILLS (Moderate productivity)	Medium	Stony slopes and undulating stony plains	Stony and gritty sandy clay loams. Some rock outcrop.	Witchetty bush and sparse mulga and Cassia spp. over woollyoat grass, minor perennial grasses and forbs.
3 (Bs-2)	OPEN WOODLAND (High productivity)	Small	Alluvial plains	Sandy clay loams.	Scattered mulga and ironwood over curly windmill grass, cotton panic grass, umbrella grass, woollyoat grass and minor forbs.
4 (Bs-2)	DRAINAGE CHANNELS (High productivity)	Very small	Shallow channels	Coarse sandy and rocky beds and adjacent sandy alluviums	River red gum and ironwood over curly windmill grass, kangaroo grasses, silky browntop and minor forbs.
5 (Bs-2)	COTTONBUSH FLAT (High productivity)	Very small	Alluvial plains	Texture contrast sandy clay loam over clay loams.	Cottonbush over woollyoat grass and umbrella grass. Minor Mitchell grass, bluegrass, Flinders grass and forbs.

6 (Bs-2)	OLD MAN SALTBUSH PLAIN (Moderate productivity)	Very small	Alluvial plains	Saline and texture contrast.	Old man saltbush over mainly oat grass. Minor umbrella grass, katoora, fairy grass and forbs.

Current Range Condition

The higher country of Bond Springs One land system is in good to excellent condition. More accessible and palatable pasture types on Bond Springs Two land system are generally in good condition with small areas close to water in fair condition.

Grazing Capacity (Bs-2 land system)

Normal season 2.0 - 2.5 per km²
Drought season 1.2 per km²

Management Hazards

i) Grazing — Minor hazard

The major units are resilient to grazing. Palatable grasses are replaced by mulga grass and copperburrs on open woodlands and cottonbush flats and by wire grass on small hills. Woody species such as broombush, oval-leaf cassia bush and ironwood may increase on open woodlands.

ii) Erosion — Slight hazard

Lower units with shallow soils are susceptible to scalding and minor rilling and gullying with heavy grazing. This vulnerability is increased on sloping saline areas.

iii) Feral Animals (cattle, horses, rabbits) — Slight hazard

Clean musters are difficult in the more hilly country with natural waters. Open woodlands have isolated pockets of rabbits.

iv) Fire — Moderate hazard

Areas with high fuel levels are prone to low to moderate intensity wildfires. Terrain makes fire control difficult.

Land Use

Bond Springs Two land system is suitable for fattening or breeding. It should be intermittently moderately stocked but will withstand continuous light stocking. Occasional summer spelling will allow palatable grasses to regain vigour and maintain future productivity.

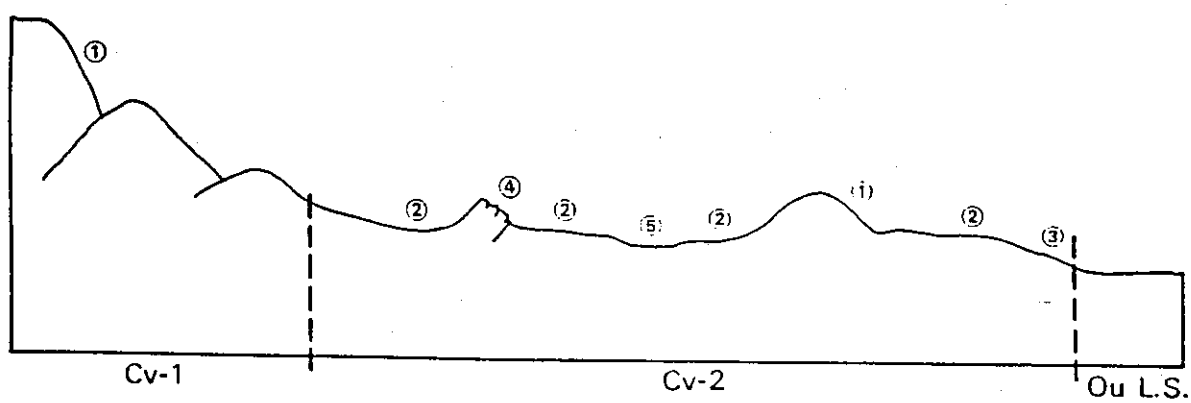
The presence of topfeed and perennial grasses in watercourses enables continuous light stocking during droughts.

Bond Springs One land system is largely inaccessible but is lightly grazed during droughts.

CAVENAGH (Cv) LAND SYSTEM (540km²)

Cv-1 (134km²) Granite hills and tors and associated foothill fans.

Cv-2 (406km²) Undulating plains with granite outcrop.



UNIT	PASTURE TYPE	EXTENT	LANDFORM	SOILS	VEGETATION
1 (Cv-1)	HILLS & TORS (Low productivity)	Medium	Granite hills and tors	Bare rock or small pockets with red shallow, gritty, loamy sands.	Mainly absent or scattered mulga, witchetty bush, wild fig and shrubs, and sparse grasses (woollybutt wandarrie, oat and woollyoat grasses)
2 (Cv-2)	OPEN WOODLAND (GRANITE) (High productivity)	Medium	Foothill fans and undulating plains	Coarse red loamy sands.	Sparse mulga, dead finish, witchetty bush, myall or needlewood over oat and woollyoat grasses. Minor mulga grass, cotton panic grass, curly windmill grass, umbrella grass and forbs.
3 (Cv-2)	BLUEBUSH SLOPE (Moderate productivity)	Small	Gentle slope	Coarse red loamy sands (calcareous at depth). Quartz gravel on surface.	Bluebush and myall over oat grass and minor umbrella grass, limestone oat grass and forbs.
4 (Cv-2)	DOLERITE DYKES (Low productivity)	Very small	Strike dyke ridges	Bare rock with small pockets of red shallow gritty, loamy sands.	Mainly absent or scattered witchetty bush and shrubs over oat grass, minor other grasses and forbs.
5 (Cv-1) (Cv-2)	DRAINAGE CHANNELS	Very small	Shallow channels	Coarse sandy beds and adjacent sandy alluviums.	Ironwood and mulga over curly windmill grass, silky browntop, kerosene grass and minor forbs.

Current Range Condition

Cavenagh One land system is in good to excellent condition.

The open woodland (granite) pasture type (Cavanagh Two land system) is in fair to good condition with some loss of oat grass and palatable perennials. Less palatable mulga grass has increased. Areas heavily grazed for long periods have sparse oat grass and increased amounts of copperburrs and ephemeral forbs.

Bluebush slopes are less resilient to stocking and have higher rabbit populations. They are generally in fair condition. Palatable perennial grasses are absent; the density and vigour of oat grass is considerably reduced and limestone oat grass, copperburrs and forbs have increased.

Grazing Capacity

Normal season	3.5 - 4.0 per km²
Drought season	1.2 per km² (destocking recommended)

Management Hazards

i) Grazing — Moderate hazard

The open woodland (granite) pasture type is highly productive in good condition but productivity is substantially reduced on areas in lower condition classes. Oat grasses increase in density and vigour with summer spelling but extended resting (2-3 years) may be necessary for recovery of small areas in poor condition.

Woody weed invasion can occur on areas in poor or fair condition with poor pasture vigour.

Bluebush slopes are preferred by both cattle and rabbits. They are usually small in area and difficult to maintain in good condition. However, if grazing pressure is manipulated to maintain the pasture type in fair condition with a stable trend, overall productivity of the land system should be held at a high level.

ii) Erosion — Moderate hazard

Open woodland (granite) areas are prone to windsheeting and slight drift. The bluebush slopes are susceptible to windsheeting and watersheeting. Maintenance of cover and pasture vigour in good seasons should assure that erosion is minimized with the onset of adverse seasonal conditions.

iii) Feral Animals (rabbits) — Moderate hazard

Rabbits are present in seasonally moderate to high densities on the calcareous and granitic soils of Cavenagh Two land system.

iv) Fire — Moderate hazard

Sufficient fuel can accumulate to carry fires after several good seasons. Under extreme weather conditions, these fires are sufficiently intense to kill mulga and other topfeed species and promote the growth of less palatable pasture species.

Land Use

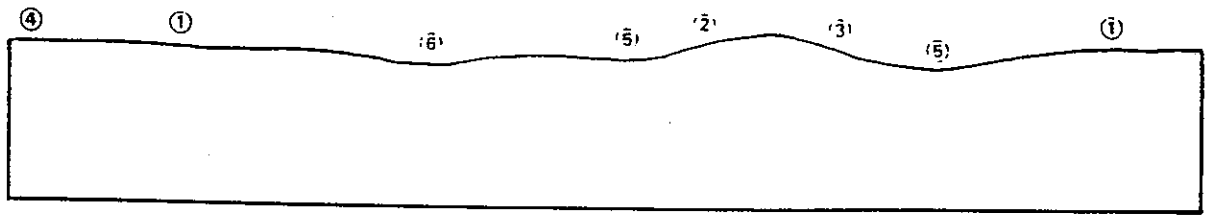
Cavenagh Two land system is best suited to fattening and should be intermittently moderately stocked. Occasional summer spelling is recommended to maintain pasture vigour. Longer spelling over two to three consecutive growth periods may be necessary on areas in poorer condition. Herd segregation and pasture spelling are not currently practised on the stations with this land system.

Very light stocking is recommended in droughts to minimise erosion.

Cavenagh One land system should be continuously lightly stocked with breeders or bullocks where able to be managed separately from Cavenagh Two land system.

OUTOUNYA (Ou) LAND SYSTEM (1020km²)

Broad granitic plains with open woodlands and calcareous shrubby grasslands.



UNIT	PASTURE TYPE	EXTENT	LANDFORM	SOILS	VEGETATION
1	OPEN WOODLAND (GRANITE) (High productivity)	Large	Plain	Red loamy sands. Minor granite outcrop and some surface quartz gravel.	Open mulga (often dead) with scattered witchetty bush, dead finish and needlewood over mainly oat grass. Minor mulga grass, cotton panic grass, curly windmill grass and forbs.
2	CALCAREOUS SHRUBBY GRASSLAND (Moderate productivity)	Small	Gentle slope (interfluve)	Red brown calcareous earth. Outcrops of calcrete and granite.	Witchetty bush, and scattered mulga, dead finish or low shrubs over oat grass. Minor perennial grasses and forbs (copperburrs, sida).
3	BLUEBUSH SLOPE (Moderate productivity)	Small	Gentle slope (interfluve)	Red brown calcareous earth; outcrops of calcrete and granite, quartz stones on surface.	Bluebush and some myall over oat grass and minor umbrella grass, limestone oat grass, copperburrs, sida and other forbs.
4	MULGA PERENNIAL (Low productivity)	Medium	Alluvial plain	Red earths and sandy over red earths.	Moderately dense mulga mainly unpalatable perennial grasses (woollybutt, bandicoot grass, wire grass) minor annual grasses and forbs.
5	COTTONBUSH FLAT (High productivity)	Very small	Alluvial plain	Texture contrast.	Cottonbush over perennial grasses (curly windmill grass, silky browntop, desert bluegrass, Mitchell grass) and annual grasses.
6	MULGA DRAINAGE DEPRESSION (Moderate to high productivity)	Small	Drainage depression	Alluvial red brown sandy loam.	Moderately dense mulga and some ironwood over perennial grasses (silky browntop, desert bluegrass, curly windmill grass, umbrella grass), annual grasses and minor forbs.

Current Range Condition

The open woodland (granite) pasture type is in poor condition close to water and where heavily infested with rabbits. Beyond 2km from water, country is in fair to good condition.

Calcareous shrubby grasslands and bluebush slopes are in mainly fair condition with areas close to water in poor condition. Highly preferred cottonbush flats are in poor to fair condition within 3 to 4km of water.

Mulga perennial areas are currently poorly watered. Small areas within grazing range of water are avoided by stock and are in good condition.

Grazing Capacity

Normal season	3.0 - 4.0 per km^2
Drought season	1.5 per km^2

Management Hazards

i) Grazing — Moderate hazard

The open woodland (granite), calcareous shrubby grassland and bluebush slope pasture types are susceptible to constant heavy grazing through further loss of palatable grasses, increase in mulga grass, limestone oat grass and copperburrs and increased risk of erosion. Broombush can increase on woodland areas in favourable seasons when pasture vigour is low.

ii) Erosion — Moderate hazard

The sandy soils of woodland areas are susceptible to drift and windsheeting when bared. Windsheeting and watersheeting can occur on bluebush slopes and calcareous shrubby grasslands with low pasture cover levels. The texture contrast soils of cottonbush flats are highly susceptible to scalding.

iii) Feral Animals (rabbits) — High hazard

Rabbits are present throughout the open woodland (granite), calcareous shrubby grassland and bluebush slope pasture types. In many areas, they have been the primary cause of pasture degradation, death of witchetty bush and lack of recruitment of topfeed species.

iv) Fire — Moderate hazard

Much of the topfeed on open woodland (granite) areas has been killed in past hot fires. Sufficient fuel is present on mulga perennial and ungrazed woodland country after most good seasons to carry fires placing mulga and other fire sensitive trees at risk.

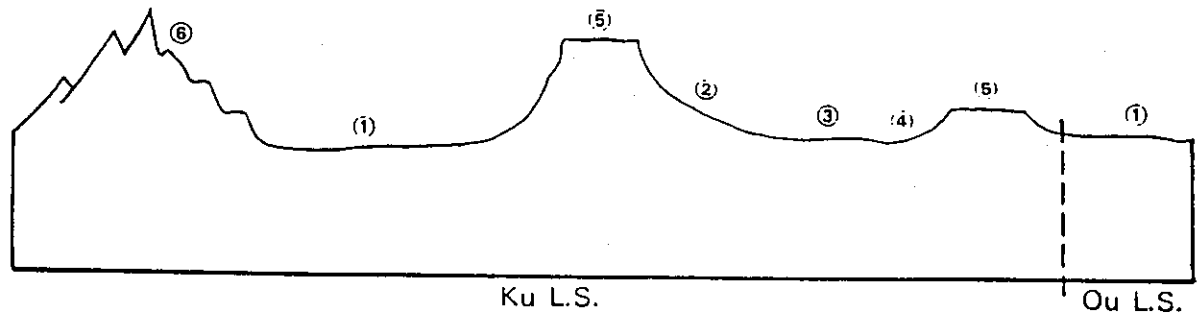
The use of fire to control small areas of dense broombush is sometimes warranted.

Land Use

Open woodland (granite), calcareous shrubby grassland and bluebush slope pasture types are best used for fattening at intermittent moderate stocking rates. Periodic summer spelling is recommended to allow palatable grasses to regain vigour. These preferred pasture types should be very lightly stocked during drought to minimize erosion hazard. Larger areas of mulga perennial form low grade breeding and stable drought reserve areas.

KULGERA (Ku) LAND SYSTEM (120km²)

Plains broken by strike dolerite ridges and laterite capped mesas with open woodland, saltbush and bluebush pasture types.



UNIT	PASTURE TYPE	EXTENT	LANDFORM	SOILS	VEGETATION
1	OPEN WOODLAND (GRANITE) (High productivity)	Medium	Plain	Coarse red loamy sands and minor granite outcrop.	Open mulga, witchetty bush, needlewood and dead finish over oat grass and minor perennial grasses (cotton panic grass, curly windmill grass, native millet) and forbs.
2	SALTBUSH SLOPE (Moderate to low productivity)	Medium	Gentle slope	Stony soils with pockets of sandy clay loam.	Satiny bluebush and bladder saltbush over sparse oat grass, copperburr and minor 8 day grass, 5 minute grass, button grass and forbs.
3	SALTBUSH PLAIN (Moderate to low productivity)	Medium	Plain	Red, medium sand over sandy clay	Bladder saltbush and bluebush over sparse curly windmill grass, cotton panic grass, oat grass, Flinders grass and minor mulga grass and forbs.
4	COTTONBUSH FLAT (High productivity)	Very small	Alluvial plain	Loamy sand over medium sandy clay (texture contrast and usually saline soils)	Cottonbush, saltbush and satiny bluebush over curly windmill grass, oat grass and minor mulga grass and button grass.
5	MESAS (Low productivity)	Small	Low laterite capped mesa	Stony surface with pockets of shallow calcareous earth.	Witchetty bush, mulga, bluebush and bladder saltbush over oat grass, limestone oat grass and copperburrs.

6	DOLERITE DYKES (Low productivity)	Small	Strike stony ridges	Bare rock with small pockets of red shallow, gritty loamy sands.	Mainly absent or scattered witchetty bush and shrubs over oat grass, minor other grasses and forbs.

Current Range Condition

The open woodland (granite) pasture type is in fair to good condition beyond 2km from water.

Saltbush slopes are in fair condition while saltbush plains and cottonbush flats are in poor to fair condition. These two communities are preferred grazing areas which have low densities of palatable perennial grasses, grow mainly short-lived pasture species and show evidence of past erosion.

Grazing Capacity

Normal season 2.5 - 3.0 per km^2
Drought season 1.3 per km^2

Management Hazards

i) Grazing — Moderate to high hazard

Open woodland (granite) areas are moderately stable to grazing. Cottonbush flats and saltbush plains are highly susceptible to further loss of perennial grasses and erosion.

ii) Erosion — Moderate to high hazard

Open woodlands are susceptible to windsheeting and drift when pasture cover and vigour are low. The texture contrast soils of cottonbush flats and saltbush plains are highly susceptible to scalding, rilling and gullying.

iii) Feral Animals (rabbits) — High hazard

Rabbit warrens occur throughout open woodland (granite) and calcareous outcrop areas.

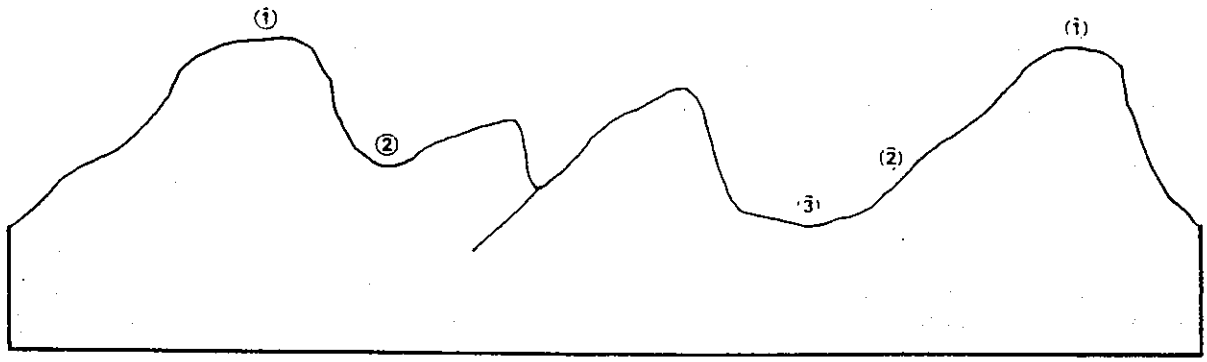
iv) Fire — Minor hazard

Land Use

Kulgera land system is currently largely used for fattening. It should be intermittently moderately stocked in better seasons and very lightly stocked in droughts. Periodic summer spelling to assist recovery of palatable grass density and vigour is recommended.

SONDER (So) LAND SYSTEM (110km²)

Bold sandstone and quartzite ranges.

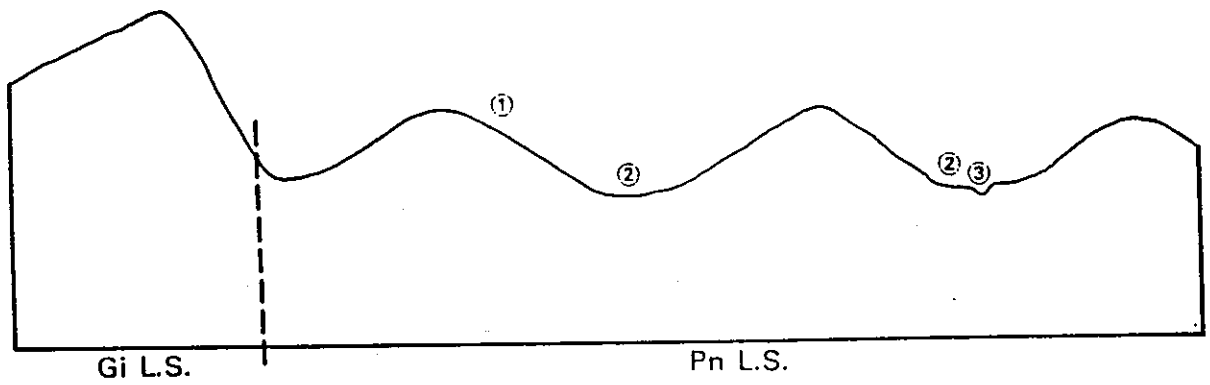


UNIT	PASTURE TYPE	EXTENT	LANDFORM	SOILS	VEGETATION
1	HIGH RANGES & RIDGES (Inaccessible)	Very large	Mountain ranges	Bare rock. Small pockets of stony and sandy soils.	Absent or small areas of low shrubs over spinifex and other hard grasses (mountain wandarrie, woollybutt wandarrie).
2	SPINIFEX HILLSLOPES (Low productivity)	Small	Foothill slopes	Rocky and stony surfaces with pockets of stony loamy sands and sandy clay loams.	Scattered mulga, witchetty bush and shrubs. Spinifex and other hard grasses (mountain wandarrie, woollybutt wandarrie, kangaroo grass) and minor annual grasses (oat grass, kerosene grass) and forbs.
3	WATERCOURSES (Low productivity)	Very small	Drainage channels	Rocks and coarse sands.	River red gum over sparse curly windmill grass, two-gland spear grass, kangaroo grass and kerosene grass.

Sonder land system is largely inaccessible to stock. Lower spinifex hillslopes and watercourses are sparingly grazed during drier seasons when within range of permanent water. Rugged country surrounding natural waters can harbour small numbers of feral horses and cattle.

PERTNJARA (Pn) LAND SYSTEM (46km²)

Spinifex covered conglomerate hills.



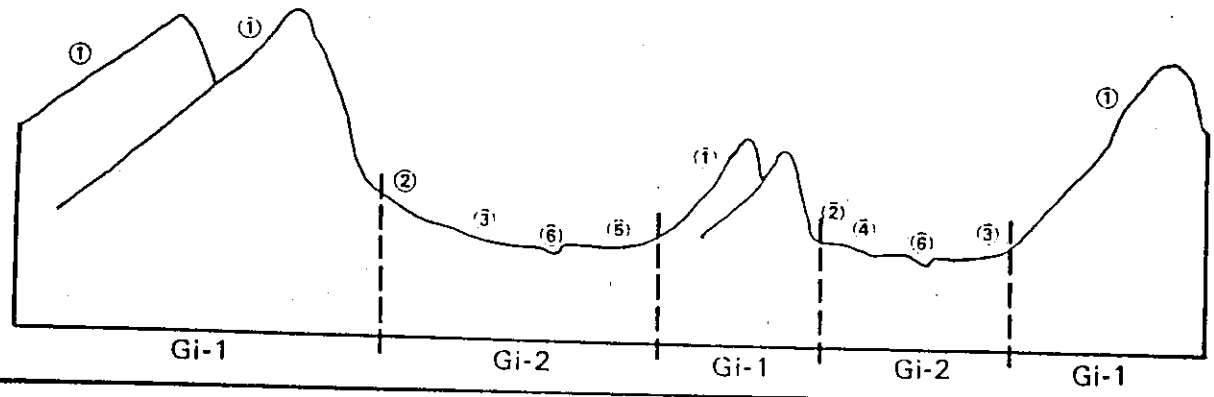
UNIT	PASTURE TYPE	EXTENT	LANDFORM	SOILS	VEGETATION
1	SPINIFEX HILLS (Low productivity)	Large	Hills and ridges	Shallow stony soils with areas of calcrete.	Sparse mulga, mallee, witchetty bush and low shrubs over spinifex.
2	OPEN WOODLAND (Moderate productivity)	Very small	Valley floors	Shallow alluvial sandy loams often stone and rock strewn.	Open ironwood, mulga and witchetty bush over mulga grass, woollyoat grass and minor perennials (curly windmill grass, umbrella grass, kangaroo grass).
3	WATERCOURSES (Moderate productivity)	Very small	Drainage channels	Coarse sands in channels. Narrow fringing alluvial sandy loam levees.	River red gum and ironwood over curly windmill grass, two-gland spear grass, kangaroo grass and kerosene grass.

Pertnjara land system is generally inaccessible from established waters. Where accessible, the more preferred small open woodland and watercourse units are usually only lightly grazed and in good condition. This land system provides small areas of stable country for drought grazing.

GILLEN (Gi) LAND SYSTEM (2745 km²)

Gi-1 (1785 km²) Rugged sandstone and quartzite ranges.

Gi-2 (960 km²) Colluvial and alluvial fans and plains.



UNIT	PASTURE TYPE	EXTENT	LANDFORM	SOILS	VEGETATION
1 (Gi-1)	HIGH RIDGES (Inaccessible)	Medium	Ridges and mountain ranges	Bare rock. Small pockets of shallow stony soil.	Absent or sparse low shrubs over spinifex and hard grasses such as wandarries and woollybutt.
2 (Gi-1) (Gi-2)	FOOTHILL RIDGES & SLOPES (Low productivity)	Small	Low ridges and hills	Rock and shallow stony soils.	Scattered mulga, witchetty bush and low shrubs over spinifex, wandarries, woollybutt, kerosene grass, mulga grass and forbs.
3 (Gi-2)	OPEN WOODLAND (Moderate to high productivity)	Medium	Alluvial fans and plains	Red brown sandy clay loams. Stony on alluvial fans.	Open ironwood, mulga, witchetty bush and corkwood over woollyoat grass, mulga grass and scattered perennial grasses (curly windmill grass, umbrella grass). Minor forbs.
4 (Gi-2)	SANDY OPEN WOODLAND (Moderate productivity)	Small	Alluvial plain	Deep red loamy sands and sandy loams.	Ironwood, mulga, witchetty bush and whitewood over kerosene grass, woollybutt, mulga grass, woollyoat grass and forbs (sidas, Chinese lantern, tar vine, paddy melon, verbine).
5 (Gi-2)	MULGA ANNUAL (Moderate productivity)	Small	Alluvial plain	Red sandy clay loam.	Moderately dense mulga over mainly woollyoat grass and mulga grass. Minor perennial grasses (cotton panic, mulga Mitchell, curly windmill and umbrella grasses) and forbs.
6 (Gi-1) (Gi-2)	WATERCOURSES (High productivity)	Very Small	Creeks and channels	Sandy and rocky stream beds. Narrow fringing alluvial sandy loams.	River red gum and ironwood over curly windmill grass, kerosene grass, oat grass and forbs.

Gillen One Land System is largely inaccessible to stock and is resilient to the light grazing received during droughts.

Gillen Two Land System

Current Range Condition

Open woodland and mulga annual pasture types confined within small paddocks or close to water are in fair, and occasionally, poor condition. These areas show loss of palatable grasses and increase in mulga and broombush. Sandy open woodlands are more resilient to grazing and generally in good condition.

Grazing Capacity

Normal season	1.7 - 2.5 per km^2
Drought season	1.0 per km^2

Management Hazards

i) Grazing — Low to moderate hazard

Constant heavy grazing leads to loss of palatable grasses and increase in density of less palatable and ephemeral species on open woodlands and mulga annual. Mulga and broombush can also rapidly increase in response to favourable seasons.

Sandy open woodlands are fairly resilient to grazing.

ii) Erosion — Low to moderate hazard

Sloping foothill fans and alluvial plains are susceptible to watersheeting and rilling when pasture cover is reduced. Open woodlands; and to a lesser extent mulga annual, may suffer windsheeting during drought.

iii) Feral Animals (horses and cattle) — Low to moderate hazard

Feral stock on natural uncontrolled waters in adjacent ranges of Gillen One land system can place intense grazing pressure on small areas of Gillen Two land system.

iv) Fire — Low hazard

Fires are often started by lightning in adjacent ranges. These are difficult to control and may burn out adjoining productive country. Firebreaks are often graded at the foot of the ranges (Gi-1) and can cause accelerated erosion when poorly sited.

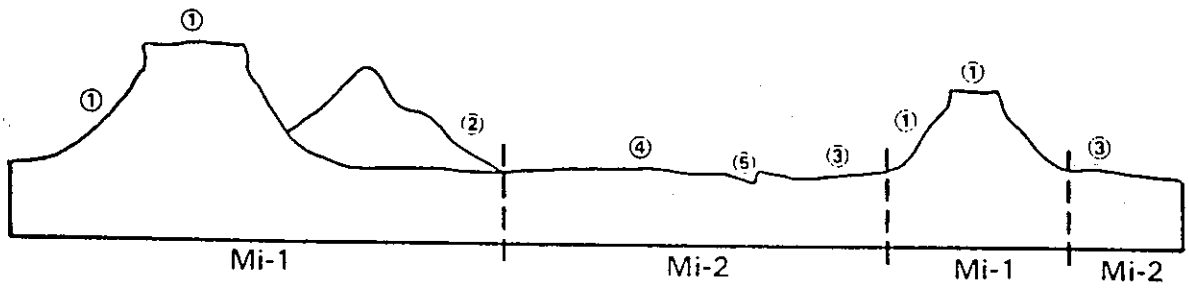
Land Use

More extensive areas of woodland and mulga annual country are best used for breeding at continuous light to moderate stocking rates. Smaller areas should be managed in conjunction with surrounding country.

MIDDLETON (Mi) LAND SYSTEM (300 km²)

Mi-1. (236 km²) Sandstone uplands, ridges and mesas.

Mi-2 (64 km²) Low mesas and ridges, foothill fans and alluvial plains.



UNIT	PASTURE TYPE	EXTENT	LANDFORM	SOILS	VEGETATION
1 (Mi-1)	UPLANDS AND PLATEAUX (Very low productivity)	Medium	Plateaux and high mesas	Rock outcrop and shallow stony soils.	Sparse mulga and low shrubs over spinifex, woollybutt, wandarries, mulga grass and forbs.
2 (Mi-1)	SANDY HILLSLOPES (Low productivity	Medium	Moderate slopes	Red aeolian sands.	Low shrubs (hopbush, broombush, Grevillia spp., emu bush) and sparse mulga and whitewood over mulga grass, kerosene grass, woollybutt, woollyoat grass and forbs.
3 (Mi-2)	OPEN WOODLAND (Moderate productivity)	Small	Alluvial fans and plains	Stony red sandy clay loams.	Scattered ironwood, mulga, witchetty bush and whitewood over woollyoat grass, mulga grass, kerosene grass, minor minor perennials (umbrella grass, curly windmill grass) and forbs.
4 (Mi-2)	SANDY OPEN WOODLAND (Low productivity)	Small	Plain	Red loamy sands.	Scattered ironwood, mulga, witchetty bush, whitewood and bloodwood over kerosene grass, woollybutt and minor woollyoat and mulga grasses and a variety of forbs.
5 (Mi-2)	WATERCOURSES (Moderate productivity)	Very small	Creeks and channels	Sandy and rocky stream beds. Narrow fringing alluvial sandy loams.	River red gum and ironwood over curly windmill grass, kerosene grass, oat grass and forbs.

Middleton One Land System is sparingly grazed by cattle in drier seasons and is resilient to the low grazing pressure that it receives.

Middleton Two Land System

Current Range Condition

Open woodlands are moderately preferred grazing areas and are in fair condition close to water. Other pasture types are less preferred, more resilient and in good condition.

Grazing Capacity

Normal season	1.3 - 1.7 per km^2
Drought season	1.0 per km^2

Management Hazards

i) Grazing — Low hazard

Constant heavy grazing can cause pasture degradation on small areas of open woodland close to water.

ii) Erosion — Low hazard

Reduced cover levels on sloping open woodland areas can result in active watersheeting, rilling and gullying. There is a slight risk of windsheeting and drift on grazed sandy open woodlands in droughts.

iii) Feral Animals (horses and camels) — Low hazard

Camels and brumbies are present in low numbers on parts of Middleton One and Two land systems.

iv) Fire — Low hazard

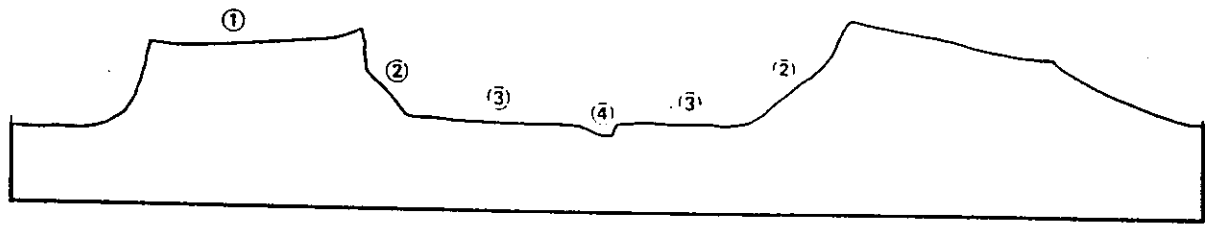
Fires occur spasmodically but cause little damage.

Land Use

Middleton Two land system is best suited to breeding at continuous light stocking rates. However, individual areas are generally not separately paddocked and should be managed in conjunction with surrounding more productive country.

KRICHAUFF (Kr) LAND SYSTEM (1067 km²)

Bold sandstone plateaux with steep dissected margins growing sparse trees and shrubs over spinifex and mainly hard grasses.



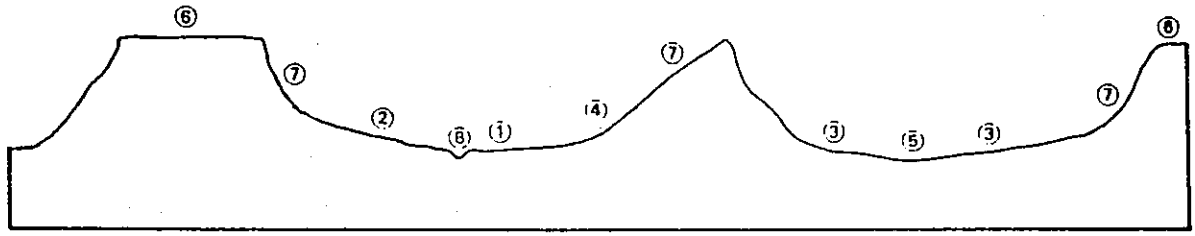
UNIT	PASTURE TYPE	EXTENT	LANDFORM	SOILS	VEGETATION
1	SPINIFEX PLATEAU (Very low productivity)	Medium	Plateau	Bare rock or with thin veneer of red sand.	Sparse trees (Acacia spp. and mallee) and low shrubs over spinifex; or minor mulga Mitchell, woollybutt wandarrie and kerosene grasses.
2	PLATEAU MARGIN (Very low productivity)	Medium	Dissected and gullied escarpment	Rock outcrop and shallow stony soil.	Bare or scattered trees (white cypress pine, mulga, witchetty bush) and shrubs (Acacia spp., fuchsia bush) over sparse spinifex, woollybutt wandarrie, annual grasses and forbs.
3	FOOTHILL FANS (Low productivity)	Small	Alluvial fans	Stony loamy sands	Sparse mulga, ironwood and whitewood over spinifex or woollybutt wandarrie, minor woollybutt, mulga grass, oat grass, kerosene grass and forbs.
4	WATERCOURSES (Moderate productivity)	Very small	Creeks and channels	Sandy and rocky stream beds. Narrow fringing alluvial sandy loams.	River red gum and ironwood over curly windmill grass, woollybutt, kerosene grass and forbs.

Access by controlled cattle to Krichauff land system is generally limited. Feral cattle and horses watering at uncontrolled surface waters have caused localised minor degradation of lower pasture types.

The lower areas of Krichauff land system provide stable grazing areas of limited use in droughts despite the difficulties in controlling cattle.

CHANDLERS (Cn) LAND SYSTEM (3032 km^2)

Mesas, low ranges and stony plains with clayey stony slope, bluebush rise and open woodland pasture types.



UNIT	PASTURE TYPE	EXTENT	LANDFORM	SOILS	VEGETATION
1	OPEN WOODLAND (Moderate productivity)	Medium	Gently undulating plain	Stony sandy clay loams.	Open whitewood, bloodwood, mulga and witchetty bush over woollyoat and mulga grasses. Scattered umbrella grass with curly windmill grass adjacent to trees. Perennial grasses more dense in small watercourses.
2	CLAYEY STONY SLOPE (Moderate productivity)	Medium	Gentle slopes below ranges	Stony clayey soils.	Generally treeless or scattered harlequin fuchsia over Mitchell grass, neverfail, katoora, oat grass and copperburrs. Very stony areas have less Mitchell grass and increased katoora and copperburrs.
3	CALCAREOUS SHRUBBY GRASSLAND (High productivity)	Small	Gently sloping plains	Brown calcareous earths.	Scattered witchetty bush, dead finish and broombush over oat grass, minor umbrella grass and forbs (sida, copperburrs, smokebush).
4	BLUEBUSH RISE (Moderate productivity)	Small	Limestone strike ridges and foothill slopes	Shallow calcareous soils.	Bluebush and oat grass with small amounts of limestone oat grass, sida, copperburrs and buckbush. Limestone oat grass more common on ridge crests.
5	COTTONBUSH FLAT (Moderate productivity)	Very small	Alluvial plains	Texture contrast - loamy sand over sandy clay.	Cottonbush and minor saltbush over curly windmill grass, silky browntop, umbrella grass, Mitchell grass, oat grass and forbs.

6	MESAS AND LOW RANGES (Low productivity)	Medium	Mesas and undulating ranges	Shallow stony soils.	Sparse mulga and low shrubs (turkey bush, broombush) over woollybutt, neverfail, kerosene grass, mulga grass, pussytails and other forbs.
7	STONY RISES (AND HILLSLOPES) (Low productivity)	Medium	Hill slopes	Very stony shallow soils.	Sparse mulga and low shrubs (emubush, broombush) over katoora and copperburrs with sparse mulga grass, oat grass, smokebush and other forbs.
8	WATERCOURSES (High productivity)	Small	Creek channels	Coarse sandy or stony creekbeds. Narrow fringing alluvial sandy loams.	Ironwood and mulga over perennial grasses (silky browntop, curly windmill grass, woollybutt), kerosene grass and forbs. Small coolibah swamps with northern bluebush, palatable perennial grasses and nardoo.

Current Range Condition

Clayey stony slopes vary considerably in condition. The majority of the area is in fair condition with reduced Mitchell grass density, increased amounts of katoora and copperburrs and past erosion. Small areas are in good condition.

Open woodland areas are in fair to good condition with some loss of palatable perennial grasses and reduction in woollyoat grass density. Calcareous shrubby grasslands are preferred grazing areas and country close to water or heavily infested with rabbits is in poor condition. This pasture type elsewhere is generally in fair condition. Bluebush rises are generally in good condition with small areas in poor and fair condition. Areas in lower condition have sparse oat grass and increased amounts of limestone oat grass and forbs in the pasture.

Cottonbush flats and coolibah swamps are highly preferred but are in generally fair condition when some distance from water.

Grazing Capacity

Grazing capacities of the different pasture types on Chandlers land system vary considerably due to their different palatabilities, pasture growth levels and current range condition. Overall, the land system has been assessed at:

Normal season	1.4 - 3.0 per km^2
Drought season	1.0 per km^2

Management Hazards

i) Grazing — High hazard

The large and more productive pasture types (clayey stony slopes, open woodlands, calcareous shrubby grasslands and bluebush rises) are moderately to highly susceptible to pasture degeneration when overstocked. Reduction in pasture cover levels and replacement of palatable perennial and annual grasses by copperburrs and less palatable grasses reduces productivity and increases the risk of accelerated erosion.

ii) Erosion — High to very high hazard

Past extensive erosion has occurred and small areas continue to actively erode.

Clayey stony slopes are highly susceptible to watersheeting, rilling and gullying. Careful placement of tracks across slopes and through watercourses is required to prevent initiation or acceleration of erosion.

Calcareous shrubby grasslands are highly susceptible to watersheeting and windsheeting when bared by heavy grazing and in droughts. Open woodlands are moderately susceptible to watersheeting.

Moderate to heavy utilization can accelerate scalding on the unstable texture contrast soils of cottonbush flats and some saline areas.

iii) Feral Animals (rabbits) — Minor hazard

Calcareous shrubby grasslands and bluebush rises are favoured habitats for rabbits and small areas of severe degradation have occurred in areas with a moderate to high density of warrens.

iv) Fire — Low hazard

Land Use

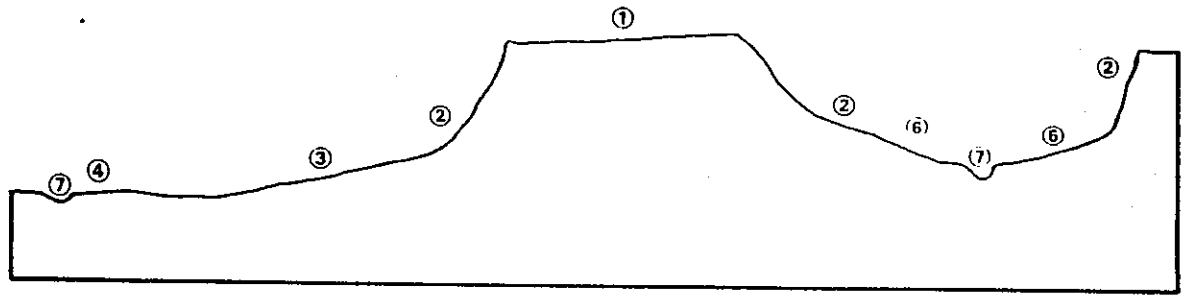
Where the more productive pasture types (calcareous shrubby grasslands, open woodlands, clayey stony slopes, bluebush rises) occur over extensive and manageable areas, they should be used for fattening at seasonally moderate stocking rates. Periodic summer spelling is recommended to allow palatable species to regain vigour and increase in density.

Areas with a predominance of less productive stony and undulating pasture types (mesas, low ranges and stony rises) are better suited to breeding at continual low stocking rates.

All areas of Chandlers land system should be very lightly stocked in droughts to reduce pasture degradation and erosion.

RUMBULARA (Ru) LAND SYSTEM (790 km^2)

High plateaux with steeply dissected margins and stony footslopes.



UNIT	PASTURE TYPE	EXTENT	LANDFORM	SOILS	VEGETATION
1	STONY PLATEAU (Low productivity)	Large	Plateaux and mesas	Bare rock or shallow stony loamy sands or sandy clay loams.	Scattered mulga and low shrubs (Cassia spp., fuchsias) over sparse grasses (woollybutt, wandarries, mulga grass, oat grass) and forbs.
2	STONY RISES (Low productivity)	Medium	Stony slopes	Rocky and stony surfaces.	Very scattered low shrubs (Cassia spp. and fuchsias) over sparse katoora, mulga grass and copperburrs. Minor oat grass, woollybutt wandarrie and other forbs.
3	CLAYEY STONY SLOPE (Moderate productivity)	Small	Gentle to moderate slopes	Stony sandy clay loams and clays.	Treeless. Mitchell grass, katoora and copperburrs with minor oat grass, mulga grass and neverfail.
4	OPEN WOODLAND (Moderate productivity)	Small	Gentle slopes and plains	Stony sandy clay loams.	Mulga, witchetty bush and some whitewood over oat grass, mulga grass, minor perennial grasses, copperburrs, sida and seasonal forbs.
5	SALTBUSH SLOPE (Moderate productivity)	Very small	Stony slopes	Shallow stony clays (slightly saline)	Bladder saltbush over curly windmill grass, oat grass and minor mulga grass, 8 day grass and forbs.
6	BLUEBUSH RISE (Moderate productivity)	Very small	Stony slopes	Shallow calcareous earths.	Bluebush over oat and limestone oat grasses with minor katoora, neverfail, copperburrs and sida.
7	WATERCOURSES (Moderate productivity)	Very small	Incised creeks and watercourses	Coarse sands and loamy sands.	Coolibah and river red gum over curly windmill grass, kerosene grass, oat grass and forbs or mulga and ironwood over similar grasses.

6	SALTBUSH SLOPE (Moderate productivity)	Small	Gentle slope	Red brown sandy clay loams; occasionally stony.	Bladder saltbush over oat grass, curly windmill grass, cotton panic grass and minor 8 day and 5 minute grasses and forbs.
7	SALTBUSH PLAIN (Moderate productivity)	Small	Alluvial plain	Red brown sandy clay loams.	Bladder saltbush over oat grass, curly windmill grass, cotton panic grass and minor 8 day and 5 minute grasses and forbs.
8	WATERCOURSES (Moderate productivity)	Very small	Incised creeks and watercourses	Coarse sands and loamy sands.	Mulga over curly windmill grass, kerosene grass, mulga grass, oat grass and forbs.
					River red gum and coolibah over kerosene grass, curly windmill grass, sandhill cane grass and forbs.

Current Range Condition

Open woodlands in the upper Goyder valley are in fair condition. Mulga grass, copperburrs and seasonal forbs have increased and replaced oat grass and palatable perennial grasses. Less preferred sandy open woodlands are in mainly good condition.

Saltbush slopes and plains are in fair condition with some areas in poor condition. Palatable grasses are sparse and ephemeral species (button grass, 5 minute grass, 8 day grass) and forbs predominate. Small areas are actively eroding. Saltbush is occasionally grazed but persists in generally vigorous dense stands.

Mulga annual is in generally good condition with small areas close to water in fair condition. Mulga perennial and higher ridge country are generally avoided by cattle.

Grazing Capacity

Grazing capacity of this land system is dependent on the area of productive woodland and saltbush country available. The upper Goyder valley has a higher grazing capacity than areas closer to Finke where mulga pasture types and broken sandy country predominate. The average grazing capacity has been assessed at:

Normal Season	1.5 - 2.7 per km^2
Drought Season	1.0 per km^2

Management Hazards

i) Grazing — Low to moderate hazard

The more productive pasture types (open woodlands, saltbush plains and slopes and mulga annual) are moderately susceptible to degradation. Constant heavy grazing leads to loss of palatable grasses, reduced cover of less palatable species and initiation of erosion through increased runoff.

Higher broken country and mulga perennial areas are generally avoided by cattle.

ii) Erosion — Low to moderate hazard

Sloping saltbush and woodland pasture types are particularly prone to water erosion following reduction in pasture cover through heavy grazing. Cattle pads and poorly sited tracks can also cause localized erosion. Erosion is a minor problem on less preferred pasture types.

iii) Feral Animals (rabbits, horses, donkeys, camels) — Low hazard

Small numbers of warrens are present mainly along creeks and watercourses. Small numbers of feral horses, camels, donkeys and cattle occur where Peebles land system is close to the Finke River.

iv) Fire — Low hazard

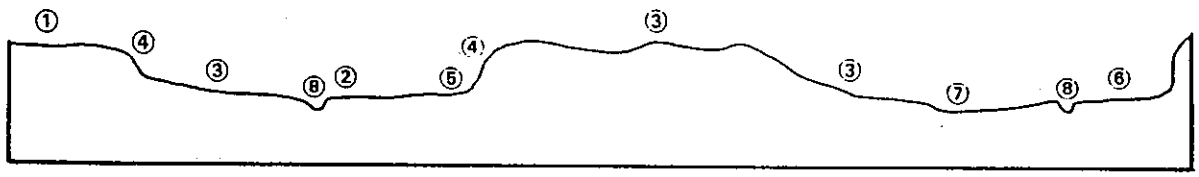
Mulga country is susceptible to wildfires but the problem can be reduced by using cool winter and spring burns to reduce fuel loads. Such fires also marginally increase the productivity of mulga perennial country.

Land Use

Peebles land system is best used for breeding at continuous light stocking rates although areas suitable for fattening are present around the upper parts of the Goyder Creek. Mulga perennial and ridge country provide low carrying, stable drought reserve areas.

LILLA (L1) LAND SYSTEM (1000 km²)

Broken stony plains with open mulga woodlands, calcareous shrubby grasslands and bluebush adjacent to the Lilla and Corella Creeks.



UNIT	PASTURE TYPE	EXTENT	LANDFORM	SOILS	VEGETATION
1	OPEN MULGA WOODLAND (Moderate productivity)	Medium	Undulating plains	Stony sandy clay loams. Often calcareous at depth.	Open stands of mulga (mostly killed by fire) over oat grass and palatable perennials (umbrella grass and curly windmill grass). Perennial grasses common in small watercourses draining this country. Small amounts of mulga grass, sida, copperburrs and other forbs present under mulga.
2	CALCAREOUS SHRUBBY GRASSLAND (Moderate to high productivity)	Medium	Gently undulating plains	Calcareous earths (often stony).	Scattered witchetty bush, dead finish and broombush over oat grass. Small amounts of limestone oat grass, umbrella grass and forbs. Some areas with very few trees or shrubs.
3	STONY PLAINS AND RISES (Low to moderate productivity)	Medium	Slopes and undulating plains	Stony sandy clay loams.	Treeless with sparse oat grass, katoora and mulga grass. Scattered cottonbush and perennial grasses in small depressions.
4	SHRUBBY RISES AND TERRACES (Low to moderate productivity)	Medium	Ridges and terraces	Stony clay loams.	Oval-leaf cassia, turkey bush and witchetty bush over sparse oat grass, mulga grass, katoora and forbs.
5	BLUEBUSH RISE (Moderate productivity)	Very small	Ridges and slopes	Stony, calcareous sandy clay loams.	Bluebush and occasional harlequin fuchsias and mulga over mainly oat grass, limestone oat grass, sida, copperburr and buckbush also present in small amounts.

6	COTTONBUSH FLAT (Moderate to high productivity)	Very small	Lower run-on areas	Texture contrast.	Cottonbush over palatable perennial grasses, (umbrella grass, curly windmill grass, desert blue grass) with minor oat grass, mulga grass and forbs.
7	ALLUVIAL BASINS AND FLOODOUTS (High productivity)	Very small	Drainage basins and floodouts	Variable. Sandy clay loams and clay loams - often scalded.	Variable. Coolibah over silky browntop, curly windmill grass, desert blue grass, cotton panic grass and forbs. Other areas treeless or with ironwood and mulga over perennial grasses and forbs.
8	WATERCOURSES (Moderate productivity)	Very small	Creek beds and sandy levees	Coarse to fine sands.	Ironwood and river red gum over tall perennial grasses (silky browntop, curly windmill grass) along creek banks. Sandy levees have prickly wattle and beefwood over kerosene grass. Very small areas of old man saltbush over oat grass, curly windmill grass, wire grass, minor button grass and forbs.

Current Range Condition

Range condition of the different pasture types reflect cattle grazing preference. Much of the surrounding country adjacent to Lilla land system is less preferred and poorly watered and consequently most of this land system has been heavily stocked in the past. Open mulga woodlands and calcareous shrubby grasslands are in poor to fair condition although very small areas remote from permanent water are in good condition. Bluebush rises and stony plains and rises are in fair condition while alluvial basins and floodouts are in poor condition.

Grazing Capacity

The more preferred and extensive pasture types in their generally reduced condition have low grazing capacities.

Normal season 2.0 - 2.7 per km^2
Drought season 1.0 per km^2

Management Hazards

i) Grazing Moderate hazard

Open mulga woodlands, bluebush rises and stony plains are moderately stable to grazing. Calcareous shrubby grasslands and small highly preferred alluvial areas (cottonbush flats, alluvial basins) are highly susceptible to prolonged overstocking and changes in pasture composition and increased erosion results.

ii) Erosion — Moderate hazard

Sloping open mulga woodlands and calcareous shrubby grasslands are susceptible to water erosion when heavily grazed. Calcareous shrubby grasslands with deeper soils are vulnerable to windsheeting when bared. Texture contrast soils, (e.g. cottonbush flats) are susceptible to scalding.

iii) Feral Animals (rabbits) — Moderate hazard

Calcareous soils and creek bank areas are favoured rabbit habitats. Rabbits have contributed to past degradation with their effect most accentuated when both rabbit and stock numbers are high.

iv) Fire — Low hazard

Past fires have caused considerable death of mulga in open mulga woodlands and little subsequent regeneration has occurred. This lack of regeneration is largely attributable to rabbits.

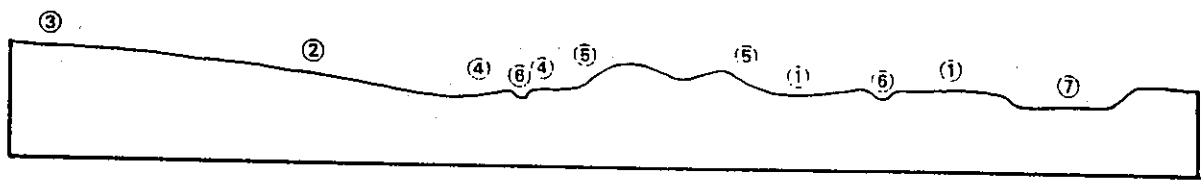
The current risk of wild fires is low due to reduced pasture productivity and present utilization levels.

Land Use

Lilla land system is best suited to fattening at moderate stocking rates. Rotational use of waters and destocking of areas to deliberately spell country for one or more successive summer growth periods will assist pastures to retain vigour. Additional subdivisional fencing is required on those stations where Lilla land system is present to allow such pasture management.

EBENEZER (Eb) LAND SYSTEM (2350 km²)

Gently undulating, stony and calcareous plains with bluebush or sparse trees and shrubs over palatable grasses and forbs.



UNIT	PASTURE TYPE	EXTENT	LANDFORM	SOILS	VEGETATION
1	CALCAREOUS SHRUBBY GRASSLAND (Moderate to high productivity)	Large	Gently undulating plain	Calcareous earths.	Witchetty bush, dead finish and broombush over oat grass, minor umbrella grass, sidas, copperburrs and seasonal forbs. Some areas very open or with small patches of broombush (a calcareous grassland).
2	BLUEBUSH SLOPE (Moderate productivity)	Medium	Gentle erosional slopes	Calcareous earths - often stony.	Bluebush, occasionally with scattered myall, dead finish and witchetty bush over oat grass, minor umbrella grass, limestone oat grass, sidas, copperburrs and seasonal forbs.
3	MULGA ANNUAL (LIMESTONE) (Moderate productivity)	Small	Gently undulating plain	Calcareous earths.	Open mulga, often killed by fire, over oat grass, minor umbrella grass, cotton panic grass, mulga grass, sida, copperburrs and seasonal forbs.
4	STONY PLAINS (Low to moderate productivity)	Small	Gently undulating stony plain	Stony, sandy clay loams.	Treeless. Oat grass, katoora and mulga grass with perennial grasses in depressions. Minor limestone oat grass, sidas and copperburrs.
5	STONY RISE (Low productivity)	Very small	Stony rise	Shallow, stony, red brown sandy clay loams.	Witchetty bush and scattered dead finish, harlequin fuchsia and broombush over oat grass, limestone oat grass, katoora, copperburrs and forbs.

6	WATERCOURSES (Moderate productivity)	Very small	Narrow, incised drainage channels Some creeks.	Medium and coarse red sands.	Mulga, ironwood and dead finish over curly windmill grass, kerosene grass and oat grass. Minor umbrella grass, cotton panic grass and forbs.
7	SALINE FLATS (Low productivity)	Very small	Entrenched valley floor	Gypseous and saline soils.	Bare or sparse samphire.

Current Range Condition

These broad calcareous plains are preferred areas for both cattle and rabbits. The majority of the land system is in fair condition with large areas close to water, continuously heavily stocked or heavily infested with rabbits in poor or very poor condition.

Grazing Capacity

Small areas in good condition have a considerably higher grazing capacity than the majority of the land system in its current condition.

Normal Season - good condition	3.5 per km^2
- poor and fair condition	2.0 - 2.5 per km^2
Drought Season	1.0 per km^2

Management Hazards

i) Grazing — Moderate to high hazard

The potential exists for preferred calcareous shrubby grasslands, bluebush slopes and mulga annual (limestone) pasture types to further degrade from their currently predominantly fair condition. Constant heavy grazing will reduce the density of oat grass, reduce total pasture cover, favour the increase of limestone oat grass and ephemeral forbs and accelerate erosion. Broombush can increase to form thickets on calcareous shrubby grasslands with low pasture density and vigour.

ii) Erosion — Moderate to high hazard

Extensive windsheeting has occurred on calcareous shrubby grasslands, mulga annual (limestone) and bluebush slopes. Slight watersheeting continues on these pasture types dependent on length and degree of slope and amount of cover. Scalding has occurred on some stony plains. Past over-grazing by stock (sometimes accentuated by rabbits) has been a significant factor.

iii) Feral Animals (rabbits) — Moderate hazard

The calcareous plains are preferred rabbit areas and populations fluctuate widely. The greatest impact on pastures is usually restricted to the immediate warren area although the impact is increased when summer rains fail and stock and rabbit numbers are high. Rabbits ringbark trees and shrubs, particularly witchetty bush, in the search for moisture when succulent herbage has disappeared and this has contributed to the widespread death and lack of regeneration of palatable topfeeds.

iv) Fire

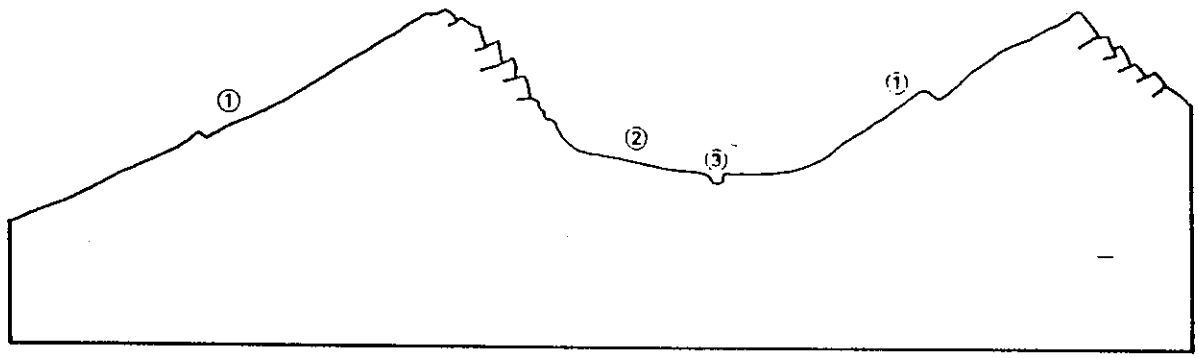
Negligible hazard

Land Use

Ebenezer land system is ideal fattening country at seasonally moderate to high stocking rates. Spelling over summer growth periods assists pastures to regain vigour. Additional subdivisional fencing and small dams (less than 6 months storage capacity) would enable greater stock control and more even utilization of pastures. Continuous grazing during droughts will accelerate degradation.

HUCKITTA (Hu) LAND SYSTEM (230 km²)

Rugged limestone ranges and steep hills broken by structural terracettes, with sparse trees and shrubs over spinifex or short grasses.



UNIT	PASTURE TYPE	EXTENT	LANDFORM	SOILS	VEGETATION
1	HIGH RIDGES and HILLS (Very low productivity)	Very large	High strike ridges	Rock outcrop with pockets of shallow, stony and sandy soils.	Sparse witchetty bush, gidyea, mulga and mallee over spinifex. Minor woollybutt wandarrie, oat grass and forbs.
2	CALCAREOUS SHRUBBY GRASSLAND (Moderate productivity)	Small	Foothill slopes	Shallow, stony calcareous soils.	Scattered witchetty bush or gidyea over oat grass and limestone oat grass with minor curly windmill grass and forbs.
3	WATERCOURSES (Moderate productivity)	Very small	Incised channels and creeks	Coarse sandy and rocky beds. Narrow sandy levees.	River red gum and ironwood over curly windmill grass, minor silky brown top, kangaroo grass, kerosene grass, oat grass and forbs.

Current Range Condition

The majority of Huckitta land system is inaccessible to controlled cattle. Limited use is made of lower calcareous shrubby grasslands and watercourses where within grazing distance of established waters. These areas are in good condition.

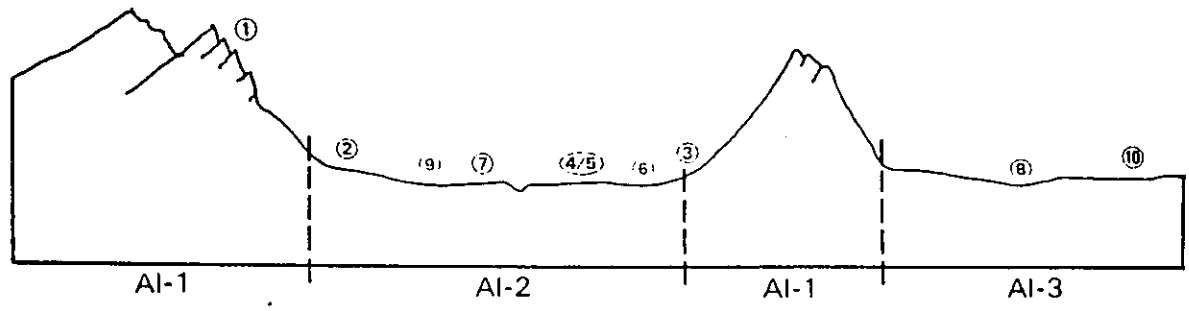
The more rugged country harbours small numbers of feral cattle and horses. Small numbers of rabbits occur in calcareous shrubby grasslands and adjacent to creeks and watercourses.

ALLUA (A1) LAND SYSTEM (770 km²)

A1-1 (233 km²) Terraced limestone ranges and higher ridges with sparse mulga, witchetty bush and shrubs over spinifex and short grasses.

A1-2 (522 km²) Foothills, lower strike ridges and alluvial valley floors with calcareous shrubby grasslands and open calcareous rises.

A1-3 (15 km²) Sandy wooded floodout and swamps of the Phillipson Creek.



UNIT	PASTURE TYPE	EXTENT	LANDFORM	SOILS	VEGETATION
1 (A1-1)	STRIKE RIDGES and HILLSLOPES (Low productivity)	Medium	Hillslopes and high ridges	Limestone outcrop and shallow stony calcareous soils.	Sparse mulga, witchetty bush, mallee and low shrubs over spinifex and minor palatable grasses and forbs.
2 (A1-2)	CALCAREOUS SHRUBBY GRASSLAND (Moderate productivity)	Medium	Gentle terraced slopes	Calcareous earths.	Scattered witchetty bush, gidyea and broombush over oat grass with minor umbrella grass, limestone oat grass, 8 day grass and forbs.
			Low strike ridges	Limestone outcrop and shallow stony calcareous earths.	As above but limestone oat grass and smokebush more common adjacent to limestone outcrop.
3 (A1-2)	OPEN CALCAREOUS RISE (Moderate productivity)	Medium	Foothill slopes and lower strike ridges	Gravelly reddish brown calcareous loams and sandy clay loams.	Sparse witchetty bush and Cassia spp. with oat grass and limestone oat grass, minor perennial grasses and forbs.
4 (A1-2)	OPEN WOODLAND (IRONWOOD) (High productivity)	Small	Alluvial plain	Reddish brown sandy clay loams.	Open ironwood and scattered gidyea, prickly wattle and witchetty bush over oat grass, curly windmill grass, minor umbrella grass, silky browntop, desert bluegrass and forbs.

5 (A1-2)	CALCAREOUS GRASSLAND (High productivity)	Very small	Plain	Dark reddish brown clay loams and sandy clay loams.	Very open with oat grass and minor umbrella grass, curly windmill grass, desert bluegrass, silky browntop, neverfail, sidas, copper-burrs and seasonal forbs.
6 (A1-2)	MULGA ANNUAL (Moderate productivity)	Very small	Plain	Reddish brown sandy loams.	Moderately dense mulga over oat grass and mulga grass. Minor cotton panic grass, mulga Mitchell grass, sidas, copperburrs and seasonal forbs.
7 (A1-2)	CALCAREOUS FLOODPLAIN (high productivity)	Small	Floodplain	Brown, sandy clay loams.	Scattered coolibah, river red gum and prickly wattle over curly windmill grass, oat grass and forbs.
8 (A1-2) (A1-3)	BLUEBUSH SWAMP (high productivity)	Very small	Swamp	Brown, sandy clay loams.	Northern bluebush swamps with minor annual grasses and forbs.
9 (A1-2)	COTTONBUSH FLAT (High productivity)	Very small	Alluvial plain	Texture contrast	Cottonbush over curly windmill grass, silky browntop, umbrella grass, desert blue grass and minor oat grass and forbs.
10 (A1-3)	SANDY WOODED FLOODOUT (Moderate to high productivity)	Small	Floodout	Sandy and silty loams.	Dense river red gum, coolibah and prickly wattle over curly windmill grass, silky browntop, buffel grass, annual grasses and forbs.

Allua One land system is lightly grazed in drier seasons and is in good condition.

The Phillipson Creek floodout (A1-3) is in poor condition with a low density of palatable perennial grasses and seasonally high proportions of ephemeral herbage and grasses. This has increased the seasonal variability in the grazing capacity of this land system.

Both Allua One and Allua Three (where present) land systems should be managed in conjunction with adjacent, less resilient, areas of Allua Two land system.

Allua Two Land System

Current Range Condition

Open woodlands, calcareous shrubby grasslands, calcareous grasslands and open calcareous rises are in fair to good condition. Small areas heavily grazed in the past are in poor condition with sparse pastures and woody weeds (mainly broombush) present.

Calcareous floodplains (including bluebush swamps) and cottonbush flats are mainly in poor condition reflecting their higher grazing preference.

Grazing Capacity

Normal season	2.3 - 3.0 per km^2 (depending on condition)
Drought season	1.0 per km^2

Management Hazards

i) Grazing — Moderate hazard

Productive open woodland and calcareous pasture types are susceptible to further degradation through changes in pasture composition, increased erosion and invasion by broombush or oval-leaf cassia.

Some small cottonbush flats and calcareous floodplains are seriously degraded but others still in fair condition could rapidly deteriorate if continuously heavily stocked.

ii) Erosion — Slight hazard

Calcareous shrubby grasslands, calcareous grasslands and open calcareous rises are susceptible to watersheeting and slight windsheeting when cover and vigour of pastures is reduced as a result of either lowered condition or heavy stocking. Cottonbush flats are prone to scalding.

iii) Feral Animals (rabbits) — Moderate hazard

Rabbits are present on calcareous pasture types. Their effects are usually restricted to the immediate area although they have contributed to more widespread pasture degradation in some areas.

iv) Fire — Low hazard

Land Use

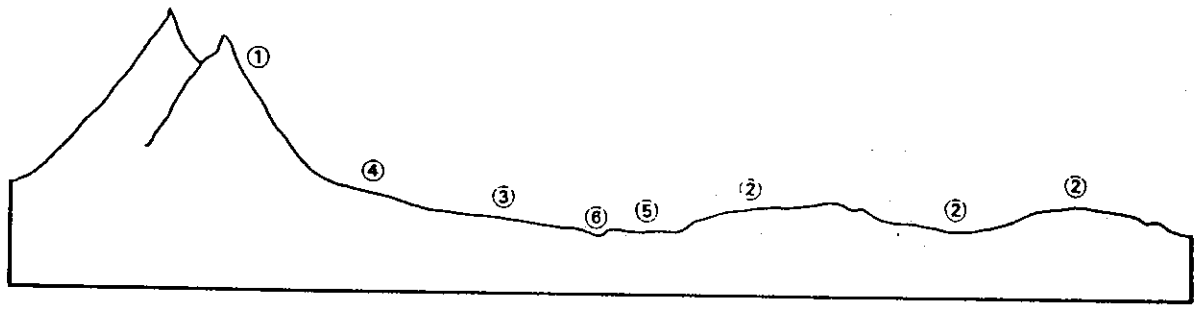
Broad areas of Allua Two land system are best suited to fattening at short-term moderate to heavy stocking rates in conjunction with pasture spelling. Smaller, and generally more broken, areas adjacent to Allua One land system are better used for breeding at continuous light to moderate stocking rates.

Judicious use of fire to control woody shrub increase may be warranted.

Small but significant areas of alluvial calcareous floodplain and cottonbush flat in poor condition would respond to short periods of destocking.

RENNERS (Rn) LAND SYSTEM (585 km²)

Undulating limestone country with witchetty bush or bluebush over mainly oat grass.



UNIT	PASTURE TYPE	EXTENT	LANDFORM	SOILS	VEGETATION
1	STONY HILLSLOPE (Low productivity)	Medium	Steep hillslope	Rock outcrop with pockets of shallow gravelly soils.	Sparse mulga and witchetty bush over sparse woollybutt, wandarries, katoora, oat grass, mulga grass, smokebush, sidas and other forbs.
2	CALCAREOUS SHRUBBY GRASSLAND (Moderate to high productivity)	Medium	Lower gentle slopes of strike rises	Calcareous earths - occasionally stony with limestone outcrop.	Scattered witchetty bush, dead finish, emubush and broombush over oat grass, minor umbrella grass, limestone oat grass, sida, copperburrs and seasonal forbs.
3	CALCAREOUS GRASSLAND (Moderate to high productivity)	Small	Valley floors	Calcareous earths.	Treeless or with some broombush, oat grass and minor umbrella grass, sida, copperburrs and seasonal forbs (swainsona, paper daisy, buckbush etc).
4	BLUEBUSH RISE (Moderate productivity)	Small	Strike rises	Shallow calcareous earths. Minor stone and limestone outcrop on strike rises.	Bluebush and occasional witchetty bush over oat grass, minor umbrella grass, sida and copperburrs. Limestone oat grass and smokebush more common in the vicinity of limestone outcrops.
5	MULGA ANNUAL (Moderate productivity)	Very small	Alluvial plain	Reddish brown, sandy loams and sandy clay loams.	Moderately dense mulga over mulga grass and oat grass with minor woollybutt, cotton panic grass, kerosene grass, sidas, copperburrs and seasonal forbs.
6	WATERCOURSES (Moderate productivity)	Very small	Incised channels. Some larger creeks	Coarse sandy and rocky beds with narrow sandy levees.	Coolibah, river red gum, ironwood and mulga over curly windmill grass, kangaroo grass, kerosene grass and forbs.

Current Range Condition

Calcareous shrubby grasslands and calcareous grasslands are in mainly fair condition with reduced oat grass density, lack of umbrella grass and seasonally high proportions of limestone oat grass and forbs. Small areas have thickets of broombush.

Bluebush slopes are generally in good condition with some areas in fair condition.

Locally dense infestations of rabbits have contributed to the degradation of these calcareous pasture types in many areas.

Less preferred mulga annual and hillslope pasture types are in good condition.

Grazing Capacity

Normal season	2.0 - 3.5 per km^2
Drought season	1.0 per km^2

Management Hazards

i) Grazing — Moderate to high hazard

Past heavy grazing by stock and rabbits has degraded many areas. There is a significant risk that future heavy grazing would reduce oat grass density and total pasture cover leading to increased erosion.

ii) Erosion — Moderate to high hazard

Past windsheeting and watersheeting have affected considerable areas. Soil loss is difficult to detect but the risk is greatly increased when pasture vigour and abundance is low. Minor scalding, rilling and gullying occurs on broad slopes adjacent to natural drainage lines.

iii) Feral Animals (rabbits and horses) — Moderate hazard

Rabbit warrens are common in the calcareous pasture types and are probably the main cause of the widespread death and lack of regeneration of witchetty bush. Rabbits, in conjunction with past overstocking, have contributed to pasture degradation and lack of recovery in range condition on much of the land system.

Feral horses are more common on adjoining land systems but are present in significant numbers on small areas of Renners land system.

iv) Fire — Low hazard

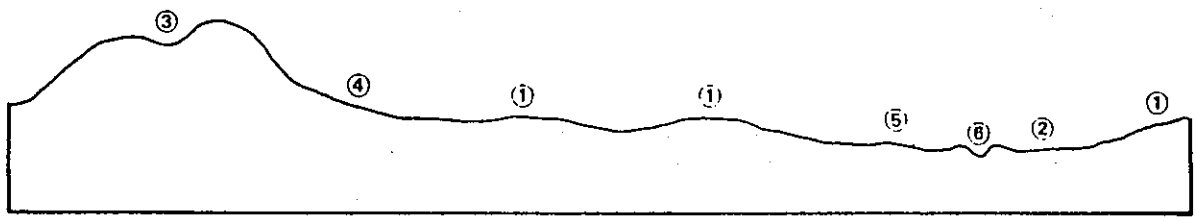
Land Use

The majority of Renners land system is good fattening country which should be intermittently stocked at moderate to high stocking rates. Pastures should be periodically spelled over summer to allow recovery in pasture vigour and density. Areas in poor condition require destocking for longer periods.

Renners land system should be very lightly stocked in dry seasons.

MULLER (Mu) LAND SYSTEM (22 km²)

Gently undulating limestone plains with witchetty bush or bluebush over short grasses.



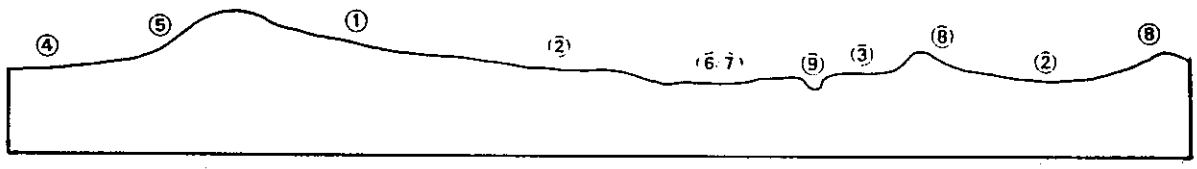
UNIT	PASTURE TYPE	EXTENT	LANDFORM	SOILS	VEGETATION
1	CALCAREOUS SHRUBBY GRASSLAND (Moderate productivity)	Large	Calcareous rises	Slightly stony calcareous earths with some limestone outcrop.	Scattered witchetty bush, dead finish, broombush and emubush over oat grass, minor limestone oat grass, smokebush, umbrella grass, sida, copperburrs and seasonal forbs.
2	MULGA ANNUAL (Moderate productivity)	Medium	Broad alluvial drainage depressions	Reddish brown sandy clay loams.	Mulga over oat grass and mulga grass. Minor woolly-butt, cotton panic grass, mulga Mitchell grass and forbs.
3	SPINIFEX HILLS (Very low productivity)	Medium	Low conglom-erate and calcrete hills	Shallow brown, stony soils with calcrete crusts.	Sparse witchetty bush and mulga over spinifex. Minor pussytails, annual grasses and forbs.
4	OPEN CALCAREOUS RISE (Moderate productivity)	Small	Calcareous rises	Shallow calcareous earths (sometimes stony).	Treeless. Oat grass and scattered umbrella grass with minor limestone oat grass, sida, copperburrs and seasonal forbs.
5	OPEN WOODLAND (Moderate productivity)	Small	Alluvial plain	Reddish brown sandy clay loams and some texture contrast soils.	Open whitewood, ironwood, mulga and witchetty bush over oat grass, moderate amounts of curly windmill grass and umbrella grass and minor desert bluegrass, silky browntop, mulga grass and forbs.
6	WATERCOURSES (Moderate productivity)	Very small	Incised channels Some larger creeks	Coarse, reddish brown sands.	River red gum or ironwood over curly windmill grass, minor annual grasses and forbs.

The small area of Muller land system within the survey region has only been lightly grazed in recent years and is in good condition. Scattered rabbit warrens occur on the calcareous pasture types but their damaging effects on pasture composition are restricted to the immediate warren area. The calcareous shrubby grassland and open woodland pasture types are resilient under light to moderate stocking provided that they are periodically allowed to recover during summer growing seasons and are very lightly stocked in droughts. The other pasture types are generally unaffected by moderate stocking.

Muller land system is suitable for fattening but the small area present is better managed in conjunction with surrounding country.

ENDINDA (Ed) LAND SYSTEM (160 km²)

Broad undulating stony plains with mulga or bluebush over mainly palatable annual grasses.



UNIT	PASTURE TYPE	EXTENT	LANDFORM	SOILS	VEGETATION
1	BLUEBUSH SLOPE (Moderate productivity)	Medium	Gentle slopes - some low ridges	Brown stony, sandy clay loams and calcareous earths.	Bluebush and occasional emubush over oat grass and small amounts of umbrella grass, limestone oat grass, sida and seasonal forbs.
2	CALCAREOUS SHRUBBY GRASSLAND (Moderate productivity)	Medium	Gentle slopes or wide swales between sand dunes	Calcareous earths - may be shallow and stony on slopes.	Scattered witchetty bush, dead finish and broombush over oat grass. Minor umbrella grass, limestone oat grass and forbs. Some areas very open - (calcareous grassland).
3	OPEN WOODLAND (Moderate productivity)	Small	Plains and gentle slopes	Reddish brown sandy loams and sandy clay loams.	Mulga and occasional whitewood, dead finish and witchetty bush over oat grass, mulga grass and scattered perennials (umbrella grass, curly windmill grass) and forbs.
4	MULGA ANNUAL (SAND) (Low to moderate productivity)	Small	Plains	Reddish brown sandy loams.	Mulga over kerosene grass, woollybutt, mulga grass, oat grass and forbs (sidas, copperburrs, swainsona).
5	SHRUBBY RISE (Low productivity)	Small	Hillslopes	Stony clays and sandy clay loams.	Over-leaf cassia, broombush and fuchsias over katoora, oat grass, mulga grass and forbs. Small amounts of Mitchell grass, neverfail and curly windmill grass in small drainage channels.

6	BLUEBUSH SWAMP (Very high productivity)	Very small	Broad drainage basin	Cracking, reddish brown, sandy clays.	Dense northern bluebush, old man saltbush and grey germander over annual grasses and forbs such as summer grasses, coopers clover, bokhara clover and annual verbine.
7	ALLUVIAL BASINS (High productivity)	Very small	Drainage basin	Sandy clay loams and sandy clays.	Coolibah or mulga and occasionally cottonbush or old man saltbush over silky browntop, desert bluegrass, oat grass, mulga grass, verbine, spiked malvastrum and other forbs.
8	DUNES (Low productivity)	Very small	Sand dune	Red sands and red clayey sands.	Broombush, hopbush and other low shrubs over kerosene grass, woollybutt, minor spinifex and annual grasses. Various seasonal forbs such as buckbush, parakeelya, swainsona and poached egg daisy.
9	WATERCOURSES (Moderate productivity)	Very small	Incised channel	Coarse red sandy beds.	Mulga and occasional witchetty bush over curly windmill grass, minor oat grass, mulga grass, kangaroo grass and forbs.

Current Range Condition

Endinda land system occurs as relatively small areas of preferred grazing country surrounded by sandy spinifex country and is usually heavily grazed. Overall, the land system is in fair condition.

Northern bluebush swamps are very stable under grazing and are in good condition.

Calcareous shrubby grasslands and bluebush slopes are in fair condition with low density and vigour of oat grass, lack of palatable perennial grasses and an increase in limestone oat grass and ephemeral species.

Open woodland pastures are also in fair condition and exhibit reduced pasture vigour and an increase in kerosene grass, mulga grass and seasonal forbs. Moderate erosion is evident.

Alluvial basins are in poor condition growing mainly lifesaver burr and sparse ephemeral forbs and grasses.

Grazing Capacity

Normal season	2.0 - 2.5 per km^2
Drought season	1.0 per km^2

Grazing capacity figures reflect lower pasture productivity due to reduced condition. Bluebush swamps and alluvial basins have high grazing capacities (6-8 per km^2) but are very small and do not greatly affect the grazing capacity of the whole land system.

Management Hazards

i) Grazing — Moderate hazard

Pasture degradation on this land system is long standing. Some areas are still slowly degrading with adverse effects most evident when both stocking rates and rabbit numbers are high.

ii) Erosion — Moderate hazard

Moderate watersheeting and slight windsheeting of calcareous shrubby grasslands and bluebush slopes has contributed to reduced pasture productivity. Moderate windsheeting and some drift has occurred on open woodland areas. The heavier clay soils of shrubby rises have undergone some accelerated rilling and minor gullying. Erosion will continue where pasture cover is poor.

iii) Feral Animals (rabbits and camels) — Moderate hazard

Calcareous pasture types, sand dune flanks and the margins of alluvial basins are infested with rabbits which have caused localised severe degradation.

Small numbers of camels occasionally graze this land system marginally increasing the grazing pressure on it.

iv) Fire — Low hazard

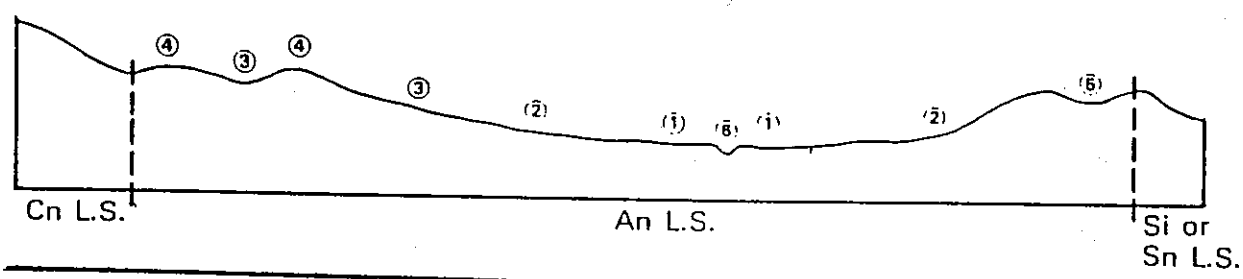
Land Use

Endinda land system is suitable for fattening at light to moderate stocking rates with regular spelling during summer growth periods. Small areas that are surrounded by harder country are better used for breeding at a continuously light stocking rate. Adjacent harder country should be burnt to improve its palatability to cattle and reduce the grazing pressure on Endinda land system.

Subdivision of Endinda land system from surrounding more resilient pasture types is not always possible. These surrounding areas will be continuously stocked during drought which imposes high grazing pressure and the danger of accelerated degradation on Endinda land system.

ANGAS (An) LAND SYSTEM (873 km²)

Undulating sandy plains with sandstone and limestone ridges.



UNIT	PASTURE TYPE	EXTENT	LANDFORM	SOILS	VEGETATION
1	MULGA ANNUAL (Moderate productivity)	Large	Sandy plain	Reddish brown sandy loams.	Open mulga and some witchetty bush over oat, woollyoat and mulga grasses. Small amounts of cotton panic and umbrella grasses and forbs such as smokebush, copperburrs, sidas and wild tomato.
			Limestone plain	Calcareous earths - occasionally stony.	Scattered mulga over mainly oat grass with small amounts of limestone oat grass, mulga grass and forbs.
2	CALCAREOUS SHRUBBY GRASSLAND (Moderate productivity)	Small	Gentle slopes and plains	Reddish brown sandy loams and sandy clay loams. Occasionally stony.	Scattered witchetty bush and broombush over oat grass, minor umbrella grass, limestone oat grass and forbs such as copperburrs and sida.
3	BLUEBUSH RISE (Moderate productivity)	Very small	Stony rise or strike ridge	Brown and reddish brown sandy clay loams.	Bluebush over oat and limestone oat grasses, sida, copperburrs and smokebush.
4	STONY RISE (Low productivity)	Very small	Strike stony ridges with some sandstone and limestone outcrop	Shallow, stony sandy loams and sandy clay loams.	Harlequin fuchsia, oval-leaf cassia and other low shrubs over sparse katoora, mulga grass, woollyoat grass and sida.
5	SPINIFEX RISE (Low productivity)	Very small	Gentle rise	Loamy sands over limestone.	Low trees and shrubs over spinifex, minor kerosene grass, woollybutt, annual grasses and forbs.
6	WATERCOURSES (Moderate productivity)	Very small	Incised channels and creeks	Coarse sandy and rocky beds.	Mulga and ironwood over curly windmill grass, kangaroo grass, kerosene grass and forbs.

Current Range Condition

Calcareous shrubby grassland and calcareous mulga annual pasture types are the most preferred grazing areas and are also infested with rabbits. These areas are in generally fair condition with increased limestone oat grass and forbs and a reduced density of oat grass in the pasture.

Extensive sandy mulga annual plains are moderately resilient to grazing and most areas are in good condition. Much of the mulga has been killed by past wildfires.

Grazing Capacity

Normal season	2.0 - 2.5 per km^2
Drought season	1.0 per km^2

Management Hazards

i) Grazing — Moderate hazard

Constant heavy grazing of the calcareous pasture types results in reduction of oat grass density and increases in limestone oat grass, copperburrs, sida and ephemeral forbs. Other less preferred pasture types are stable under grazing.

ii) Erosion — Low to moderate hazard

Sandy mulga annual plains are prone to windsheeting and drift when bared. Mulga annual on limestone is slightly susceptible to windsheeting. Calcareous shrubby grasslands and bluebush rises are susceptible to both windsheeting and watersheeting.

iii) Feral Animals (rabbits) — Low hazard

Moderate and periodically high rabbit densities occur on calcareous areas. Their damaging effects are generally restricted to the immediate warren area. Control techniques such as ripping could virtually eliminate rabbits from some areas.

iv) Fire — Moderate hazard

In good condition, the productive mulga annual and calcareous shrubby grassland pasture types will carry moderate intensity wildfires. Such wildfires have caused widespread mulga death. Regular burning of adjoining spinifex country in a mosaic pattern will reduce the risk of wildfires spreading onto productive areas of Angas land system.

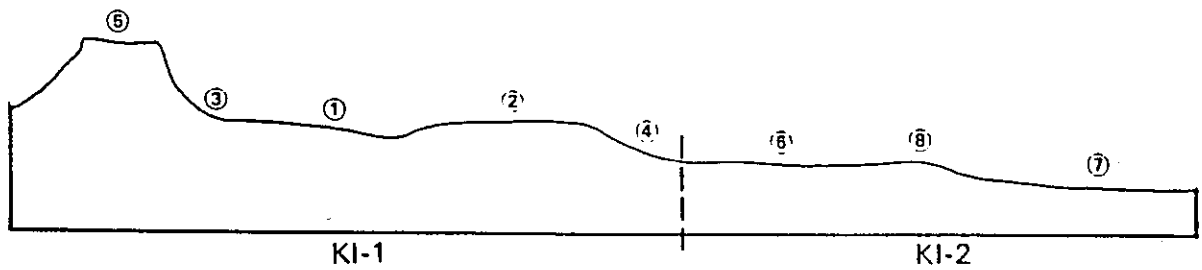
Land Use

Angas land system is suitable for either breeding or fattening at moderate stocking rates with occasional spelling. Most country in fair condition would improve if spelled for one or more growing seasons. Manageable areas of predominantly calcareous country should be very lightly stocked in droughts while sandy mulga annual areas should be lightly stocked.

KALAMERTA (K1) LAND SYSTEM (805 km²)

K1-1 (335 km²) Low sandstone mesas and broad rises with bluebush and saltbush plains.

K1-2 (470 km²) Broad sandy plains with myall and bluebush or mulga over mainly perennial grasses.



UNIT	PASTURE TYPE	EXTENT	LANDFORM	SOILS	VEGETATION
1 (K1-1)	SALTBUSH PLAIN (Moderate productivity)	Medium	Plain	Reddish brown, loamy sands and sandy clay loams.	Bladder saltbush (occasionally with scattered bluebush) over oat grass, curly windmill grass, and cotton panic grass. Minor mulga grass, umbrella grass, 8 day grass, copperburrs and other forbs.
2 (K1-1)	CALCAREOUS SHRUBBY GRASSLAND (Moderate productivity)	Small	Gentle slope	Calcareous earths.	Scattered witchetty bush and occasional mulga, myall, dead finish and broombush over oat grass, minor umbrella grass, limestone oat grass, sidas, copperburrs and forbs.
3 (K1-1)	BLUEBUSH SLOPE (Moderate productivity)	Very small	Gentle slope	Stony, reddish brown, sandy clay loams.	Bluebush and occasional bladder saltbush over oat grass, minor umbrella grass, limestone oat grass, sidas, copperburrs and forbs.
4 (K1-1)	BLUEBUSH RISE (Moderate productivity)	Very small	Foothill slope	Stony, reddish brown, sandy loams.	As for bluebush slope but limestone oat grass more common in a less dense pasture.
5 (K1-1)	MESA (Low productivity)	Very small	Mesa	Bare rock and pockets of shallow, stony soils.	Scattered mulga, witchetty bush and shrubs over sparse katoora, oat grass, mulga grass and forbs.

6 (K1-2)	MYALL WOODLAND (Moderate productivity)	Medium	Plain	Calcareous earths.	Moderately dense myall over bluebush and oat grass. Minor perennial grasses (umbrella grass, curly windmill grass), limestone oat grass and forbs..
				Small areas of reddish brown sandy loams.	Bluebush absent and increased woollybutt and kerosene grass.
7 (K1-2)	MULGA PERENNIAL (Low productivity)	Large	Plain	Reddish brown, deep sandy loams.	Mulga (slightly groved) over kerosene grass and woollybutt. Minor mulga Mitchell grass, bandicoot grass, mulga grass and forbs.
8 (K1-2)	MULGA ANNUAL (Moderate productivity)	Small	Plain	Reddish brown, deep sandy loams.	Mulga over oat grass, mulga grass and minor mulga Mitchell grass and forbs.

Kalamerta One Land System

Current Range Condition

Palatable pasture types, and particularly saltbush plains, within 4 km of water are in poor condition. The majority of the remainder is in fair condition with very small areas in good condition.

Preferential grazing of saltbush plains has reduced the density of palatable perennial grasses and oat grass and a less productive pasture of sparse 8 day grass, 5 minute grass, button grass and scattered oat grass now remains. Saltbush has satisfactorily withstood short periods of intensive grazing.

Calcareous shrubby grasslands and bluebush pastures have also been heavily grazed and a less vigorous pasture of oat grass with increased amounts of sida and copperburrs remains. They are mainly in fair condition.

Grazing Capacity

Normal season	2.0 per km^2
Drought season	1.0 per km^2

Management Hazards

i) Grazing — Moderate hazard

Although seriously degraded by past grazing, the condition of most pasture types has now stabilized. Slightly accelerated erosion will continue but should have only a slight effect on current productivity.

ii) Erosion — Moderate hazard

Saltbush plains will continue to rill and gully because of low pasture cover levels. Calcareous shrubby grasslands and bluebush slopes are vulnerable to windsheeting and watersheeting which will affect the future ability of these pasture types to recover if spelled.

iii) Feral Animals (rabbits) — Moderate hazard

Rabbits have contributed to the degradation of calcareous pasture types. Their widespread distribution means that myxomatosis is the only current practical method of control.

iv) Fire — Very low hazard

Land Use

Pastures of Kalamerta One land system are suited to fattening at seasonally moderate stocking rates. Two or more years spelling is required to allow pastures to regain some of their former productivity.

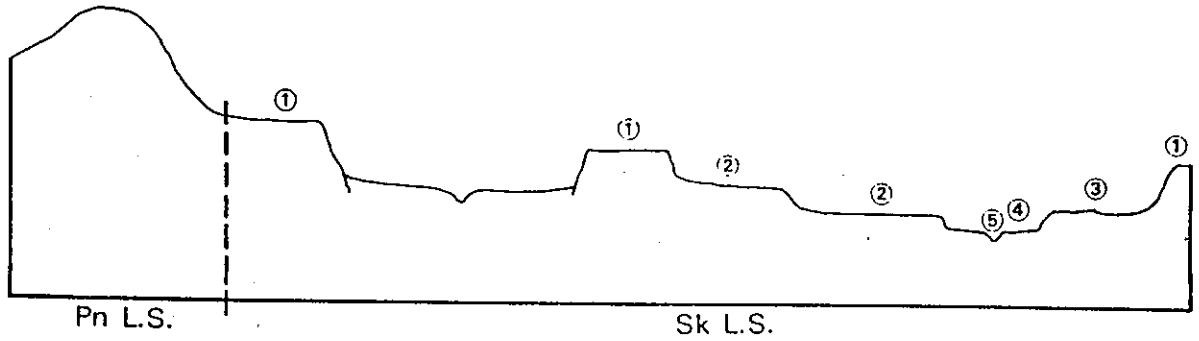
Kalamerta Two Land System

The less preferred mulga pasture types are currently poorly watered. They should be developed as low carrying breeding country and stable drought reserve areas.

Parts of the myall woodland pasture type are heavily grazed and also infested with rabbits and are in poor to fair condition. This more productive pasture type should be lightly stocked in conjunction with adjacent broader areas of Kalamerta One land system.

STOKES (Sk) LAND SYSTEM (64 km^2)

Gravel terraces and dissected valleys with mulga over spinifex and mainly low palatability grasses.



UNIT	PASTURE TYPE	EXTENT	LANDFORM	SOILS	VEGETATION
1	MULGA TERRACE (Low productivity)	Large	Terraced benches and slopes	Stony, shallow red earths.	Mulga and low shrubs (turkey bush, Cassia spp.) over spinifex with minor woollybutt, mulga grass, woollyoat grass and forbs.
2	MULGA ANNUAL (Moderate productivity)	Medium	Lower gentle slopes and valley floors	Red earths with some gravel.	Mulga over woollyoat grass and mulga grass with minor perennials (cotton panic grass, woollybutt) and forbs.
3	MULGA PERENNIAL (Low productivity)	Small	Plain	Sandy red earths.	Mulga over woollybutt, bandicoot grass and kerosene grass with minor annual grasses and forbs.
4	OPEN WOODLAND (Moderate productivity)	Very small	Foothill slopes and alluvial fans	Stony sandy loams and sandy clay loams.	Open mulga, whitewood, witchetty bush and bloodwood over woollyoat and mulga grasses, minor perennials (umbrella grass, curly windmill grass) and forbs.
5	WATERCOURSES (Moderate productivity)	Very small	Incised channels and creeks	Rocky and sandy beds and narrow fringing sandy levees.	River red gum or ironwood and mulga over curly windmill grass, kangaroo grass, kerosene grass and forbs.

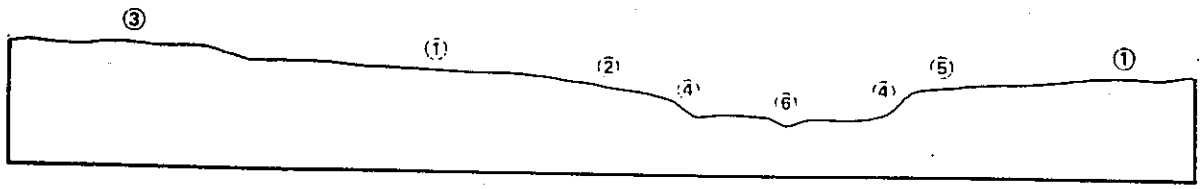
The majority of Stokes land system within the survey region is locked amongst the James Ranges and is not presently managed. This area was not inspected. Pasture type descriptions are derived from areas inspected outside of the survey region.

Stokes land system is fairly resilient to grazing and it is probable that most of the country is in good condition. Feral cattle and horses in the James Ranges are likely to have degraded small areas within grazing range of surface waters.

The predominance of harder pasture types means that the land system is best suited to breeding, where it is able to be developed, and also provides a small area of stable drought reserve country.

LINDAVALE (Li) LAND SYSTEM (1560 km^2)

Sandy calcareous plains with mulga and spinifex and low limestone escarpments and outcrops growing witchetty bush and bluebush.



UNIT	PASTURE TYPE	EXTENT	LANDFORM	SOILS	VEGETATION
1	MULGA ANNUAL (SAND) (Low to moderate productivity)	Medium	Plain	Deep reddish brown sandy loams.	Scattered mulga over woollyoat grass, mulga grass and kerosene grass. Minor umbrella grass, cotton panic grass and forbs.
2	CALCAREOUS SHRUBBY GRASSLAND (Moderate productivity)	Medium	Gently sloping to level plains	Calcareous, gravelly, reddish brown sandy loams.	Scattered witchetty bush and occasional myall over oat grass with minor limestone oat grass, umbrella grass, sida, copperburrs and seasonal forbs (swainsona, paper daisy etc).
3	SPINIFEX SANDPLAIN (Low productivity)	Medium	Plain with occasional low dunes	Deep red clayey sands or loamy sands.	Mulga and low shrubs (broombush, hopbush) and occasional desert oak over spinifex, woollybutt, kerosene grass and forbs. Small areas grow mainly kerosene grass or woolly-butt.
4	LIMESTONE RISE (Moderate productivity)	Small	Stony rises and escarpments	Shallow, stony calcareous earths.	Witchetty bush and/or bluebush over oat grass with minor umbrella grass, limestone oat grass, sidas, copperburrs, smokebush and other forbs. Sidas and smokebush more abundant than in calcareous shrubby grassland.
5	BLUEBUSH SLOPE (Moderate productivity)	Small	Gentle slope	Gravelly calcareous earths.	Bluebush with occasional witchetty bush and myall over oat grass, minor umbrella grass, limestone oat grass, sidas, copper-burrs and seasonal forbs.

6	DRAINAGE DEPRESSION (Moderate productivity)	Very small	Drainage depressions	Reddish brown sandy clay loams and clay loams.	Coolibah, ironwood, dead finish and mulga over curly windmill grass, umbrella grass, woollyoat grass and forbs. Small areas of lignum.

Current Range Condition

The majority of the sandy pasture types are in good condition. Small areas of mulga annual have been seriously degraded by rabbits and are in poor or fair condition growing kerosene grass, wild tomato and other ephemeral forbs. Mulga on these areas has been killed in past fires and rabbits have prevented subsequent regeneration.

Calcareous pasture types are in poor condition. These areas are generally surrounded by less preferred sandplains and are a focus for intensive cattle grazing. They are also heavily infested with rabbits. Bluebush is present in vigorous dense stands but witchetty bush has been very heavily browsed. Pastures are dominated by copperburrs, wild tomato and other unpalatable forbs with sparse limestone oat grass also present.

Grazing Capacity

The generally degraded state of calcareous pasture types means that this country now has a similar grazing capacity to the less palatable sandy pasture types.

Normal season	1.5 per km^2
Drought season	0.8 per km^2

Management Hazards

i) Grazing — Low hazard

Most of Lindavale land system has stabilized in poor or fair condition. Mulga annual (sand) and spinifex sandplain areas in better condition are resilient to the low grazing pressure they receive.

ii) Erosion — Low hazard

Minor wind drift will occur on sandy pasture types during droughts.

Past windsheeting and watersheeting has removed much of the thin sandy surface from the calcareous shrubby grassland, bluebush slope and limestone rise pasture types. The soil mantle is now relatively stable but is a less favourable environment for pasture re-establishment.

iii) Feral Animals (rabbits) — Moderate hazard

Rabbits are widespread on the calcareous pasture types and locally dense on the mulga annual (sand) pasture types. Lower range condition has improved the quality of feed available for rabbits. They have been responsible for much of the past death of topfeed, and more recently, lack of regeneration of witchetty bush and mulga in above average rainfall years.

iv) Fire Low hazard

Wildfire many decades ago killed much of the mulga on mulga annual areas. Subsequent droughts and rabbits have prevented regeneration. Small areas have sufficient fuel to carry fires after good rains.

Land Use

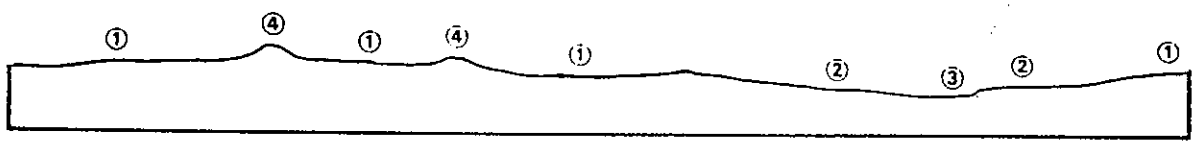
Lindavale land system is generally most suitable for breeding although reasonably extensive areas of the calcareous pasture types, if present, can fatten cattle for short periods after rain. The land system should be lightly stocked.

Patch burning of adjoining spinifex country (Lindavale, Simpson or Singleton land systems) would make these low productivity areas more attractive to cattle and slightly reduce the grazing intensity on the calcareous and mulga annual (sand) pasture types.

Mulga annual (sand) pastures in fair condition will increase in vigour and density if spelled during good summer growth periods. Calcareous shrubby grasslands, bluebush slopes and limestone rises in poor and fair condition would require several years spelling and then only marginally improve in productivity because of the presence of rabbits. These pasture types should be very lightly stocked in droughts.

KAREE (Ka) LAND SYSTEM (980 km²)

Groved mulga plains and mulga drainage depressions.



UNIT	PASTURE TYPE	EXTENT	LANDFORM	SOILS	VEGETATION
1	MULGA PERENNIAL (Low productivity)	Large	Plain	Red clayey sands and red earths.	Groved mulga with some broombush, turkey bush and witchetty bush over woollybutt, mulga Mitchell grass, bandicoot grass, kerosene grass, wire grass and minor mulga grass, woollyoat grass and forbs.
2	MULGA ANNUAL (Moderate productivity)	Very small	Plain	Red earths and red sandy loams.	Mulga over woollyoat grass, oat grass and mulga grass with minor woollybutt, cotton panic grass, mulga Mitchell grass, sidas, copperburrs and forbs.
3	MULGA DRAINAGE DEPRESSION (Moderate productivity)	Very small	Broad shallow drainage floors	Red earths.	Dense mulga with minor broombush over curly windmill grass, silky browntop, desert bluegrass and minor annual grasses and forbs. The dense tree canopy often restricts pasture growth.
4	LOW DUNES (Low productivity)	Very small	Low dune	Red clayey sands.	Low shrubs (broombush, hopbush, sand hill wattles and grevillias) over woollybutt, kerosene grass, minor annual grasses and forbs.

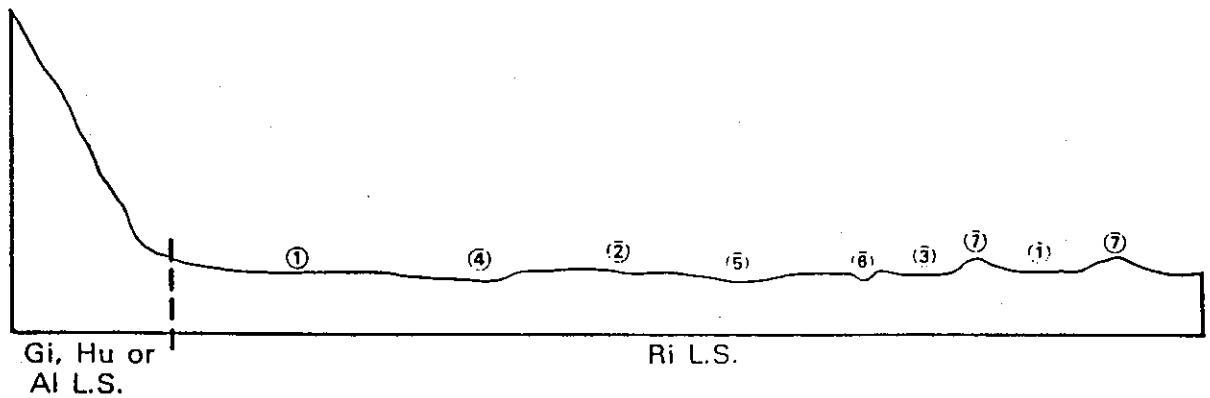
Karee land system is poorly preferred stable country and is only occasionally lightly grazed. Large areas, where present, can be developed with additional fencing as low carrying breeding country (1.2 per km²). Cattle confined on the mulga pasture types may develop peg leg and phosphorus supplementation should be a part of routine herd management.

Small areas that occur adjacent to more palatable pasture types are lightly grazed in droughts.

Mulga is susceptible to hot fires. Hot fires also encourage the growth of unpalatable wire grass. Karee land system should be protected from wildfire by mosaic burning spinifex pastures which often fringe the mulga. Cool winter fires within Karee land system also reduce the wildfire hazard, thin some of the mulga and promote the growth of a more nutritious pasture.

RINGWOOD (Ri) LAND SYSTEM (1124 km²)

Alluvial plains with gidyea over palatable grasses and forbs.



UNIT	PASTURE TYPE	EXTENT	LANDFORM	SOILS	VEGETATION
1	OPEN WOODLAND (GIDYEA) (High productivity)	Large	Slightly dissected alluvial plain	Red earths and calcareous earths. Small areas of red brown sandy loam.	Scattered gidyea and broombush over oat grass with curly windmill grass under the gidyea. Minor button grass, 8 day grass, copperburrs, sidas and other forbs (tar vine, swainsona, Birdsville indigo).
		Small	Hummocky plain	Reddish brown sandy loams and loamy sands.	Clumped gidyea and low shrubs over oat grass and kerosene grass with curly windmill grass under the gidyea. Minor mulga grass, button grass, 8 day grass, purple plume grass, copperburrs, sida and seasonal forbs (tarvine, swainsona).
2	OPEN WOODLAND (IRONWOOD) (High productivity)	Medium	Alluvial plain	Brown and reddish brown sandy loams and sandy clay loams.	Ironwood over oat grass, scattered umbrella grass and curly windmill grass (mainly adjacent to trees). Minor annual grasses and forbs. Many areas have dense stands of juvenile ironwood.
3	SANDY OPEN WOODLAND (Moderate productivity)	Small	Plain - sometimes hummocky	Dark red and reddish brown, sandy loams and loamy sands.	Very open gidyea and occasional corkwood, whitewood and ironwood over oat grass, kerosene grass and woollybutt. Scattered perennials (curly windmill grass, umbrella grass) and seasonal forbs (sida, buckbush, verbine).

4	BLUEBUSH SWAMP (Very high productivity)	Very small	Drainage basin	Reddish brown clays.	Dense northern bluebush and grey germander over minor neverfail, curly windmill grass, Flinders grass and other annual grasses and palatable forbs (annual verbine, Coopers clover, rhyncosia).
5	DRAINAGE DEPRESSION (High productivity)	Very small	Drainage depression	Reddish brown, clay loams and light clays - often texture contrast.	Treeless or gidyea or mulga. Neverfail and minor curly windmill grass, Mitchell grass, oat grass, Flinders grass, button grass, sickle lovegrass, pepper grass and forbs.
6	WATERCOURSE (High productivity)	Very small	Incised channels and creeks	Stony and sandy beds with narrow sandy levees.	River red gum, ironwood and mulga over curly windmill grass, kangaroo grass, kerosene grass and forbs.
7	LOW DUNES (Low productivity)	Very small	Low dunes	Red loamy sands.	Cassia spp. and colony wattle with sandhill cane grass, tangled leuchenaultia, kerosene grass and woollybutt. Minor oat grass, annual grasses and a diversity of seasonal forbs.

Current Range Condition

The majority of Ringwood land system is in fair condition. Productive ironwood and gidyea woodlands which have been heavily grazed in the past or are close to water are in poor condition. There has been a decrease in the vigour and abundance of palatable grasses and an increase in unpalatable copperburrs and short-lived forbs on these areas. Small areas of gidyea woodland remote from water are in good condition. Many areas have dense juvenile ironwood or gidyea.

Bluebush swamps, lightly stocked in recent years, are in good condition. Elsewhere they are in poor condition.

Grazing Capacity

The majority of accessible grazing areas comprise gidyea and ironwood woodlands with normal season grazing capacities of 2.3-4.0 beasts per km^2 depending on condition. Sandier areas have a grazing capacity of 1.2-2.0 per km^2 with swamps and floodouts having a very high carrying capacity of up to 8.0 beasts per km^2. The overall carrying capacity has been assessed at:

Normal season	3.0 per km^2
Drought season	1.2 per km^2

Management Hazards

i) Grazing — Moderate hazard

Pastures and soils are moderately susceptible to continued overstocking. Pasture vigour rapidly declines,palatable grasses disappear and the low pasture cover levels increase soil susceptibility to erosion.

ii) Erosion — Moderate hazard

The sandy soils are highly susceptible to drift during droughts. Sandy open woodlands retain good infiltration characteristics but windsheeting of sandy loam gidyea and ironwood woodlands reduces future pasture cover and affects species composition. Long gentle slopes with sandy clay loam and texture contrast soils are susceptible to watersheeting and minor rilling.

iii) Feral Animals — Low hazard

iv) Fire — Low hazard

Land Use

Ringwood land system is good fattening country which tolerates short term heavy stocking. It is also suitable for breeding at a continuous moderate grazing intensity. The more extensive gidyea and ironwood woodlands should be spelled every few years to allow recruitment of palatable grasses and a general increase in pasture density and vigour. Immediate destocking is required to allow recovery of areas in poor condition.

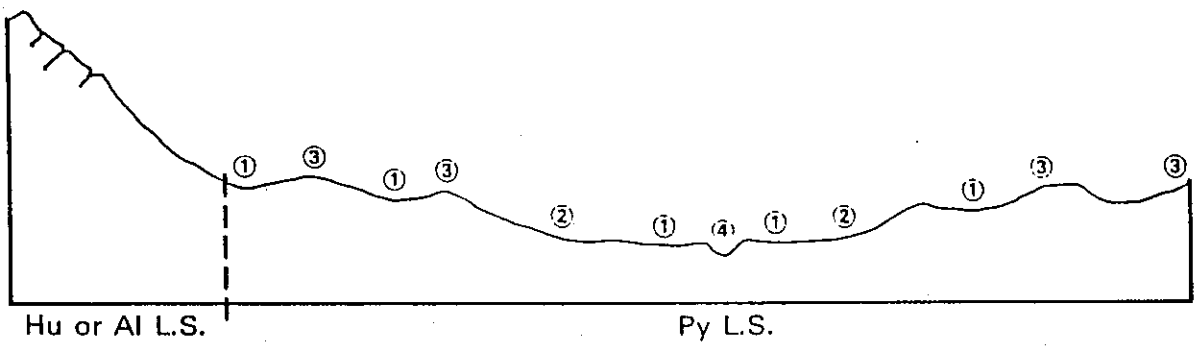
Ringwood land system should be very lightly stocked during droughts.

Controlled burns may reduce the density of juvenile ironwood and gidyea. However, most of these thickets are now well established and occur on well grazed areas precluding the accumulation of required fuel loads for a sufficiently intense fire.

Parts of Ringwood land system have been destocked in the last decade through the failure of waters and this, combined with high rainfall years, has accounted for the spectacular recovery of some small bluebush swamps.

PULYA (Py) LAND SYSTEM (65 km²)

Undulating plains with gidyea.

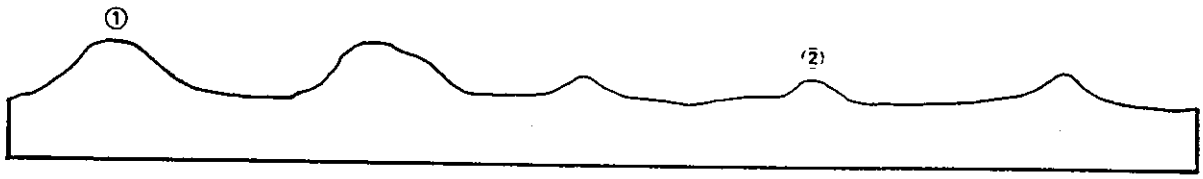


UNIT	PASTURE TYPE	EXTENT	LANDFORM	SOILS	VEGETATION
1	OPEN WOODLAND (GIDYEA) (Moderate productivity)	Large	Plains and gentle rises	Moderately deep red sandy loams and sandy clay loams.	Open gidyea over oat grass, kerosene grass, mulga grass and forbs. Curly windmill grass under gidyea and in small depressions.
		Small	Foothill slopes and fans	Deep red sandy loams and loamy sands.	Dense pockets of gidyea over mainly bare ground. Sparse oat grass, kerosene grass, mulga grass, curly windmill grass and forbs.
2	CALCAREOUS SHRUBBY GRASSLAND (Moderate productivity)	Small	Low hills and rises	Shallow stony calcareous earths and sandy clay loams.	Witchetty bush and shrubs over oat grass and minor limestone oat grass, curly windmill grass, umbrella grass and forbs.
3	STONY SLOPES (Low productivity)	Small	Broad gentle slopes	Stony sandy clay loams and loamy clays.	Sparse mulga and whitewood with pockets of broombush over oat and woollyoat grasses,katoora, mulga grass and forbs. Small amounts of Mitchell grass, curly windmill grass and other perennials.
4	WATERCOURSES (Moderate productivity)	Small	Creeks and water-courses	Stony and rocky channels with sandy loam levees.	River red gum, ironwood or prickly wattle over curly windmill grass, minor annual grasses and forbs.

The small area of Pulya land system that occurs within the survey region is currently very lightly grazed and is in good condition. The various pasture types are moderately stable to grazing and have low erosion hazard. The available area complements either breeding or fattening on adjacent broader land systems.

SIMPSON (Si) LAND SYSTEM (15690 km²)

Predominantly spinifex-covered sand dunes.



UNIT	PASTURE TYPE	EXTENT	LANDFORM	SOILS	VEGETATION
1	SPINIFEX SAND DUNES (Very low productivity)	Very large	Dunes and narrow swales	Red sands on dunes. Swales variable from red clayey sands to calcareous earths.	Dune crests often bare or with sparse spinifex. Dune flanks stabilized by low shrubs (hopbush, Cassia spp. etc) or desert oak and spinifex with very minor woollybutt, kerosene grass and forbs. Swales grow spinifex through kerosene grass to oat grass and forbs depending on soil type.
2	LOW DUNE FIELDS (Moderate productivity)	Small	Low dunes and wide swales	Red sands on dunes. Sandy loams, sandy clay loams and calcareous earths in swales.	Shrub thickets of Cassia spp. or hopbush on dunes with spinifex, sandhill cane grass, woollybutt and kerosene grass. Swales grow oat grass and minor kerosene and mulga grasses and seasonal forbs.

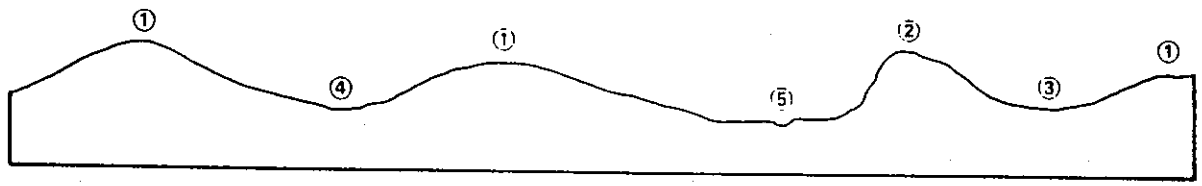
Spinifex sand dunes are avoided by cattle unless either recently burnt or cattle are confined on such areas. The more extensive dune fields throughout the region harbour small numbers of camels. These areas are resilient to grazing and should be regularly burnt in a mosaic pattern to reduce wildfire hazard to adjacent, more productive, country and to encourage some movement of cattle out onto regenerating burnt areas.

Softer pastures in the wide swales of low dune fields are seasonally grazed by cattle. Swales with calcareous soils are often infested with rabbits and small areas of localized degradation occur.

Simpson land system grows pockets of succulent herbage (e.g. parakeelya, munyeroo) after cool season rains which can fatten small numbers of cattle and enables cattle to graze for long periods without water.

EWANINGA (Ew) LAND SYSTEM (800 km²)

Undulating sandy country with irregular dunes growing mainly spinifex.



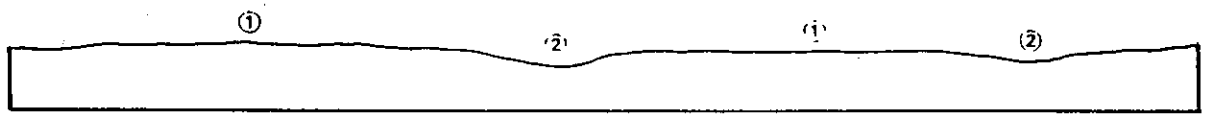
UNIT	PASTURE TYPE	EXTENT	LANDFORM	SOILS	VEGETATION
1	SPINIFEX SAND DUNES (Very low productivity)	Large	Low ridges and dunes with variable width swales	Red clayey sands on dunes. Swales variable.	Mallee, desert oak and shrubs (Cassia spp., hopbush) over spinifex. Woollybutt, kerosene grass, forbs and minor palatable grasses present in swales.
2	STONY HILLS (Low productivity)	Small	Hills and lower slopes	Shallow stony soils. Small areas of calcrete and calcareous earths.	Scattered witchetty bush and low shrubs over oat grass, limestone oat grass, katoora, copperburrs and other forbs.
3	CALCAREOUS SHRUBBY GRASSLAND (Moderate productivity)	Very small	Valley floor and lower foothill slopes	Shallow, often stony calcareous earths.	Scattered witchetty bush and broombush over oat grass, minor umbrella grass, limestone oat grass and forbs.
4	CLAYPAN (Low productivity)	Very small	Claypan	Clays - often saline.	Bare or with lignum and ephemeral grasses and forbs.
5	WATERCOURSE (Low to moderate productivity)	Very small	Narrow streambeds	Sands.	Sparse mulga, ironwood and low shrubs over curly windmill grass, kerosene grass and forbs.

Small areas of Ewaninga land system are moderately intensively grazed while large areas are either not stocked or only occasionally grazed. Cattle preferentially graze calcareous shrubby grasslands and small areas of calcareous outcrop. These areas are often infested with rabbits and localized small areas of pasture degradation occur.

Ewaninga land system provides stable areas for drought reserve or running small numbers of breeders. Spinifex sand dunes should be regularly burnt to reduce wildfire hazard and promote a softer pick for cattle.

SINGLETON (Sn) LAND SYSTEM (2990 km²)

Spinifex sand plains.

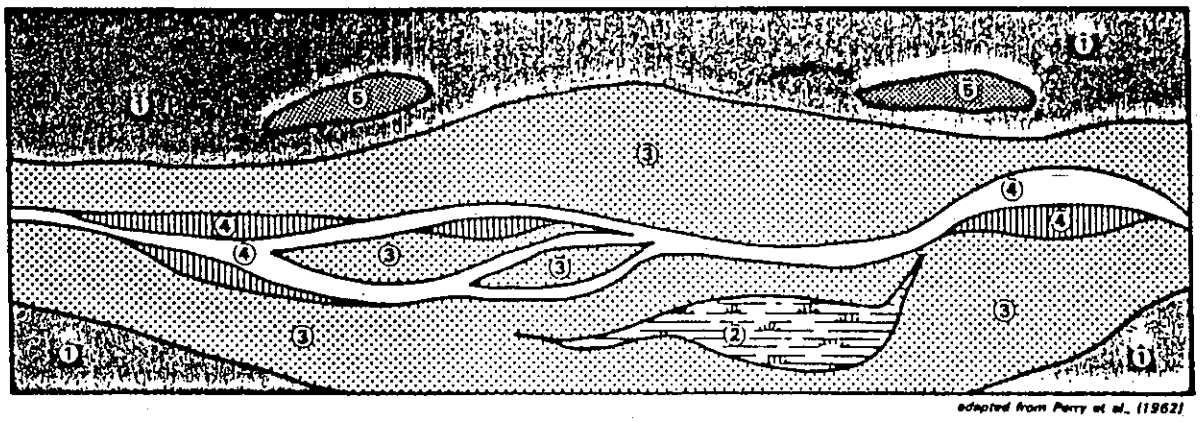


UNIT	PASTURE TYPE	EXTENT	LANDFORM	SOILS	VEGETATION
1	SPINIFEX SAND PLAIN (Very low productivity)	Very large	Level to slightly hummocky plain. Occasional low rises and very broad swales	Red clayey sands.	Sparse trees(mulga, mallee, desert oak, beefwood) and shrubs over spinifex with very minor woollybutt, kerosene grass and forbs. Small areas with mulga over mainly kerosene grass and woollybutt.
2	MULGA DRAINAGE DEPRESSION (Moderate productivity)	Very small	Broad drainage depression	Red earths.	Mulga and occasional coolibah or ironwood over spinifex and woollybutt or oat grass and forbs.

Singleton land system has a very low grazing capacity unless recently burnt. Large areas are either undeveloped or are lightly stocked in droughts. Much of the area could be used as low grade breeding country with regular mosaic burning.

FINKE (Fi) LAND SYSTEM (847 km²)

Sandy alluvial plains adjacent to major rivers.



UNIT	PASTURE TYPE	EXTENT	LANDFORM	SOILS	VEGETATION
1	ALLUVIAL SANDPLAIN (Moderate productivity)	Large	Hummocky plain	Fine sands and loamy sands.	Treeless or with occasional prickly wattle. Kerosene grass, oat grass and a diversity of forbs (verbine, rattlepods, sidas, paddy melon, Birdsville indigo).
2	COOLIBAH FLOODOUT (Very high productivity)	Small	Broad alluvial basins	Silty and texture contrast soils.	Coolibah over curly windmill grass, silky browntop, desert blue grass, umbrella grass, annual grasses and seasonal forbs. Small areas with mainly old man saltbush.
3	FLOODPLAIN (Moderate to high productivity)	Small	Level active floodplain	Texture contrast. Natural scalds and windpiled sands.	Scalded areas bare or growing galvanised burr and goathead. Sand mounded areas growing mainly kerosene grass and forbs. Stable areas have cottonbush and palatable perennial grasses.
4	RIVER CHANNELS & SANDY LEVEES (Moderate productivity)	Small	Wide channels and levees	Sandy bed loads. Levees have loamy sands and fine sands.	River red gum and some coolibah and prickly wattle over curly windmill grass, buffel grass, sandhill cane grass, kerosene grass and forbs.
5	DUNES (Very low productivity)	Very small	Dunes	Reddish sands.	Colony wattle and low shrubs with sandhill cane grass, spinifex, kerosene grass and forbs.

Current Range Condition

Finke land system has been almost continuously heavily grazed by cattle and horses since first settlement of the Alice Springs district. Parts of the land system are also a preferred habitat for rabbits.

Most of Finke land system is in poor condition. Palatable grasses have disappeared from many areas; sandplains are extensively drifted and floodplains severely scalded. Dense thickets of prickly wattle periodically occur and some stream bank floodplain and floodout areas have dense stands of river red gum or coolibah saplings.

Despite this generally poor condition throughout, Finke land system remains seasonally highly productive due to ephemeral forb growth on alluvial sandplains, colonization of stream banks by buffel grass and the persistence of some perennial grasses in coolibah floodouts.

Grazing Capacity

Finke land system has highly variable seasonal productivity making an average assessment of grazing capacity difficult. Our assessment of seasonal grazing capacity based on current condition is:

Normal and better seasons	1.2 - 4.6 per km^2
Drought season	0.4 per km^2

Management Hazards

i) Grazing — Moderate hazard

Extensive pasture degradation has occurred over the majority of the land system. Most areas have stabilized in a poor state with one of the characteristics being very large seasonal fluctuations in pasture species composition and animal productivity.

ii) Erosion — High hazard

Floodplains are very susceptible to further scalding when bared during dry seasons. Such scalds either remain bare or grow unpalatable galvanized burr and goathead.

Extensive natural drift can occur on alluvial sandplains during droughts. Heavy stocking leading to the baring of these sandy soils in dry seasons accelerate and accentuate this drift.

iii) Feral Animals (rabbits, horses, donkeys) — Moderate hazard

The sandy pasture types are a refuge habitat for rabbits in droughts. Rabbits can reach locally high densities throughout the land system in better seasons and prevent the recovery of destocked or lightly grazed areas.

Moderately dense populations of feral horses water at surface waters in the Finke River and increase the total grazing pressure on the land system.

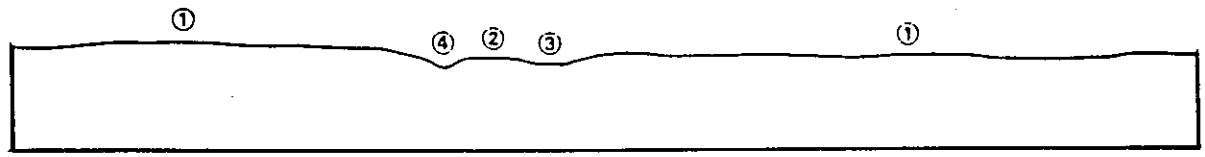
Small numbers of donkeys are present on lower parts of the Finke River within the survey region.

Finke land system allows opportunistic fattening after flooding of alluvial basins or rainfall leading to palatable herbage growth on alluvial sandplains. In most seasons, it provides useful breeding country which should be lightly stocked. The whole land system should be very lightly stocked in dry seasons.

Improvement in range condition is possible where it is practical to subdivide Finke land system from adjacent less preferred country. Stock numbers and feral horses can then be controlled and pasture management strategies instigated. Spelling alone will enable recovery of many areas. Introduction of buffel grass could also be warranted. Burning to control woody weeds should also be undertaken where fuel levels are adequate.

AMULDA (Au) LAND SYSTEM (190 km²)

Sandy foothill fans and plains growing predominantly spinifex with mulga watercourses.



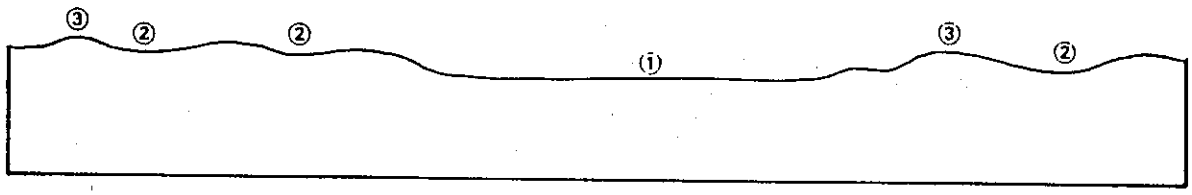
UNIT	PASTURE TYPE	EXTENT	LANDFORM	SOILS	VEGETATION
1	SPINIFEX SANDPLAIN (Very low productivity)	Large	Hummocky plain. Minor sandstone outcrop or low dunes	Red clayey sands.	Mallee, mulga, witchetty bush and low shrubs over spinifex and minor woollybutt, kerosene grass and forbs.
2	MULGA FAN (Low productivity)	Small	Alluvial fans	Red clayey sands. Small areas of red sandy clay loam and some stone outcrop.	Mulga and low shrubs (Cassia spp., hopbush) over spinifex, kerosene grass, woollybutt and minor mulga grass, woollyoat grass and forbs.
3	DRAINAGE DEPRESSION (Moderate productivity)	Small	Broad drainage depression	Alluvial clayey sands and sandy clay loams.	Mulga and some ironwood and low shrubs over woollyoat grass, mulga grass, kerosene grass, woollybutt and scattered palatable perennials (curly windmill grass, silky browntop).
4	CREEK (Moderate productivity)	Very small	Incised channel	Sandy and rocky bedloads. Narrow sandy levees.	Mulga and ironwood over curly windmill grass, kangaroo grass, kerosene grass and forbs.

The majority of Amulda land system is in good condition being only lightly or intermittently grazed. These areas could be developed as low carrying breeder country with regular, mosaic burning of spinifex sandplains to increase their attractiveness to cattle.

The Ulta Creek floodout in the northern part of the survey region is moderately intensively used and is in poor condition. This area has dense stands of broombush, hopbush and other unpalatable shrubs and sparse pastures of unpalatable grasses and ephemeral forbs.

KANANDRA (Kn) LAND SYSTEM (40 km²)

Sandy alluvial plains.



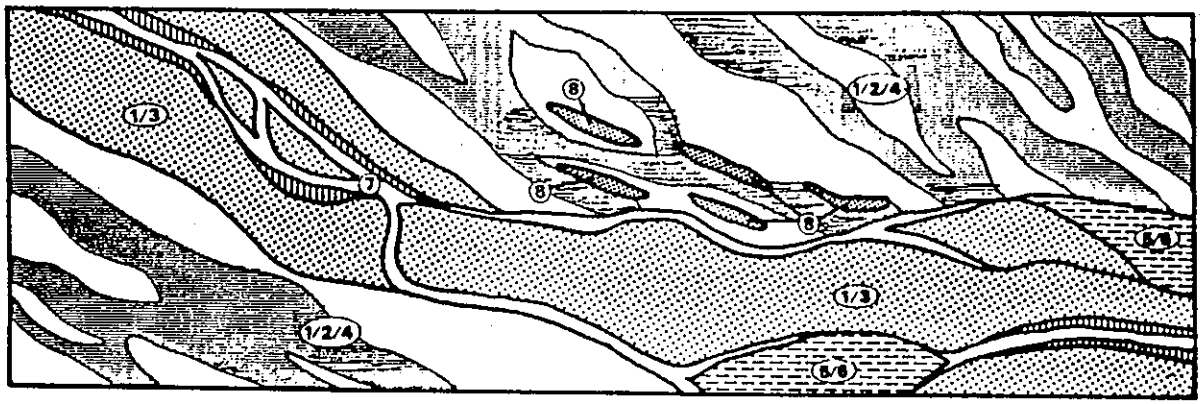
UNIT	PASTURE TYPE	EXTENT	LANDFORM	SOILS	VEGETATION
1	SANDY OPEN WOODLAND (Moderate productivity)	Large	Slightly hummocky plain.	Deep loamy sands.	Open whitewood, witchetty bush, corkwood, ironwood and low shrubs over kerosene grass, woollybutt, woollyoat grass, mulga grass and seasonal forbs. Scattered umbrella and curly windmill grasses.
2	SANDPLAIN (Low productivity)	Small	Hummocky plain	Deep sands and loamy sands.	Thickets of colony wattle and firebush over kerosene grass, woollybutt and seasonal forbs. Minor woollyoat, oat and mulga grasses.
3	DUNES (Low productivity)	Very small	Low dunes	Red sands.	Low shrubs and sandhill cane grass, woollybutt, kerosene grass and patches of spinifex.

The small area of Kanandra land system within the survey region is in fair condition due to the loss of palatable perennial grasses and a reduction in the density of woollyoat grass. Past minor windsheeting and drift has occurred on sandy open woodlands.

Kanandra land system is suitable for breeding and is stable under moderate grazing pressure in most seasons. It should be lightly stocked in droughts to prevent loss of palatable species and accelerated windsheeting and drift.

TODD (Td) LAND SYSTEM (705 km²)

Open woodland plains and floodouts of the Todd River.



adapted from Perry et al., (1962)

UNIT	PASTURE TYPE	EXTENT	LANDFORM	SOILS	VEGETATION
1	OPEN WOODLAND (High to very high productivity)	Large	Gently undulating plains	Reddish brown sandy clay loams and sandy loams.	Open whitewood, supplejack, ironwood, mulga, witchetty bush and corkwood over woollyoat and oat grasses, curly windmill grass, umbrella grass and other palatable perennials. Minor mulga grass and forbs.
2	SANDY OPEN WOODLAND (Moderate productivity)	Medium	Slightly hummocky plain	Red loamy sands and sandy loams.	Open ironwood, whitewood, mulga and witchetty bush over woollyoat and oat grasses, kerosene grass, mulga grass, woollybutt and forbs.
3	CLAYEY ALLUVIAL PLAIN (Very high productivity)	Small	Alluvial basins	Brown sandy clay loams and clay loams.	Generally treeless. Dense palatable perennial grasses (umbrella grass, curly windmill grass, silky browntop, desert bluegrass). Minor oat and woollyoat grasses and forbs. Small areas invaded by wire grass are less productive.
4	MULGA ANNUAL (Moderate productivity)	Medium	Plain	Red earth.	Moderately dense mulga over woollyoat and mulga grasses. Minor cotton panic grass, umbrella grass, curly windmill grass and forbs.
5	COTTONBUSH FLAT (Very high productivity)	Very small	Alluvial basin	Texture contrast.	Cottonbush with palatable perennial grasses (curly windmill grass, umbrella grass, blue grasses) and oat and woollyoat grasses. Minor mulga grass and forbs.

6	COOLIBAH FLOODOUT (Very high productivity)	Very small	Distributary channels and broad alluvial basins	Silty loams and clays.	Coolibah and some river red gum over curly windmill grass, silky browntop, annual grasses and ephemeral forbs. Small areas of old man saltbush.
7	RIVER CHANNELS (Moderate productivity)	Very small	Main channels and narrow levees	Sandy beds and loamy sand levees.	River red gum and fronwood over curly windmill grass, silky browntop, two-gland spear grass, kangaroo grass, buffel grass, kerosene grass and forbs.
8	DUNES (Low productivity)	Very small	Low dunes	Red sands.	Colony wattle and low shrubs with sandhill cane grass, tangled lechenaultia, kerosene grass, woollybutt and forbs.

Current Range Condition

Open woodlands, clayey alluvial plains and cottonbush flats are preferred pasture types which are heavily grazed. Cottonbush flats are in poor to fair condition with reduced pasture growth and lower densities of palatable perennial grasses. Open woodlands and clayey alluvial plains are moderately resilient to heavy grazing and most areas are in fair or good condition. Small thickets of broombush have established on some open woodland areas. Unpalatable wire grass dominance of clayey alluvial plains, which is currently confined to small areas, is rapidly expanding.

Less preferred sandy open woodlands and mulga annual areas are in good condition.

Grazing Capacity

Normal season 4.0 - 5.8 per km^2
Drought season 1.5 per km^2

Management Hazards

i) Grazing Moderate hazard

Open woodlands and clayey alluvial plains tolerate short term heavy grazing provided that palatable grasses are periodically allowed to regain vigour and increase in density. Prolonged overstocking, particularly in dry seasons, will eliminate palatable species and reduce sustained productivity.

Mulga annual and sandy open woodland pasture types are resilient to moderate stocking.

Cottonbush flats are a focus of concentrated grazing and it is difficult to control grazing access to these small areas. Thus, these areas are highly susceptible to continued pasture degradation.

ii) Erosion — Moderate hazard

Open woodlands are susceptible to windsheeting and watersheeting when bared. Cottonbush flats and other small areas with texture contrast soils are highly vulnerable to scalding.

iii) Feral Animals — Very low hazard

iv) Fire — Low hazard

Land Use

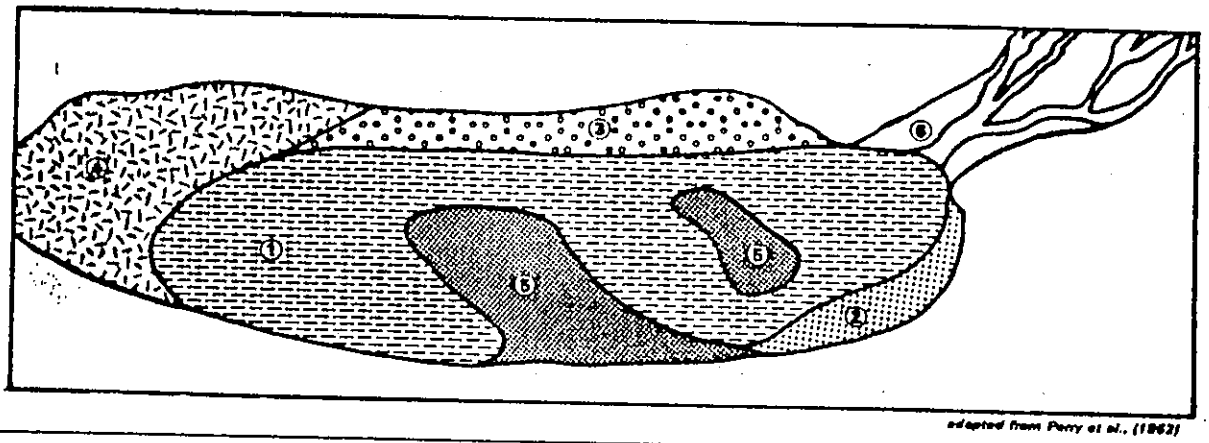
Todd land system is highly productive fattening country and is also used for breeding. Open woodlands and clayey alluvial plains withstand both short periods of heavy stocking or longer periods of moderate grazing pressure. Areas should be periodically rested over summer growing periods to allow a recovery in pasture composition and vigour.

Sandy open woodlands and mulga annual provide areas of resilient country which should be the main grazing areas in drier seasons. This will protect more preferred open woodlands, cottonbush flats and clayey alluvial plains from pasture degradation and soil erosion.

Controlled fires should be used to thin thickets of broombush as ground fuel levels permit.

AMADEUS (Aa) LAND SYSTEM (590 km²)

Salt lakes and fringing dunes.



UNIT	PASTURE TYPE	EXTENT	LANDFORM	SOILS	VEGETATION
1	SALT LAKES & PANS (No productivity)	Large	Central pan floors	Waterlogged saline clays.	Bare
2	BLUEBUSH RISE (Moderate productivity)	Very small	Calcrete terrace	Calcrete and shallow calcareous earths.	Scattered bluebush over oat and limestone oat grasses. Minor sida, copperburrs and other forbs.
3	CALCAREOUS SHRUBBY GRASSLAND (Moderate productivity)	Very small	Calcrete terrace	Calcrete and shallow calcareous earths.	Scattered witchetty bush over oat and limestone oat grasses. Minor sida, copperburrs and other forbs.
4	SANDPLAIN (Low productivity)	Small	Hummocky plain	Aeolian gypseous and calcareous sands.	Tea tree and some witchetty bush over kerosene grass, oat grass and a diversity of seasonal forbs.
5	DUNES (Very low productivity)	Very small	Low dunes	Red sands.	Some low shrubs. Sandhill cane grass or spinifex with woollybutt, kerosene grass and forbs.
6	DRAINAGE DEPRESSIONS & CHANNELS (Low productivity)	Very small	Generally broad channels	Generally saline clays. Some sandy soils.	Tea tree and low shrubs with samphire and Frankenia spp. Sparse oat grass, kerosene grass, 8 day grass and forbs.

The larger lakes provide temporary supplies of stock water after rain expanding the total watered area. Cattle and rabbits have degraded many small fringing bluebush rises and calcareous shrubby grasslands to poor condition. Small areas of sandplain are also in poor condition growing largely unpalatable and ephemeral forbs.

Amadeus land system should be managed in conjunction with surrounding, generally sandy, country and is most suitable for running small numbers of breeders.

APPENDIX 1

SCIENTIFIC NAMES OF PLANTS MENTIONED IN THE TEXT

Acacia	(t,s)*	Acacia spp.
Athel pine	(t)	Tamarix aphylla
Bandicoot grass (Mulga oats)	(pg)	Monachather paradoxa
Bathurst burr	(f)	Xanthium pungens
Beefwood	(t)	Grevillea striata
Birdsville indigo	(f)	Indigofera linnaei
Bladder saltbush	(s)	Atriplex vesicaria
Bloodwood	(t)	Eucalyptus terminalis
Bluegrass	(pg)	Dichanthium sericeum
Bluebush	(s)	Maireana astrotricha
Bogan flea (Bindy eye)	(f)	Calotis hispidula
Bokhara clover	(f)	Melilotus albus
Broombush	(s)	Cassia nemophliola
Buckbush (Prickly saltwart)	(f)	Salsola kali
Buffel grass	(pg)	Cenchrus ciliaris
Button grass	(ag)	Dactyloctenium radulans
Caltrop	(f)	Tribulus terrestris
Camel weed (Tall yellowtop)	(f)	Senecio magnificus
Cartwheel burr	(f)	Sclerolaena cornishiana
Cassia	(s)	Cassia spp.
Caustic vine	(s)	Sarcostemma australe
Caustic weed	(f)	Euphorbia drummondii
Chinese lantern	(f)	Abutilon otocarpum
Chocolate bush	(s)	Cassia oligophylla
Colony wattle	(s)	Acacia murrayana
Coolibah	(t)	Eucalyptus microtheca
Cooper clover	(f)	Trigonella suavissima
Copperburr	(f)	Sclerolaena spp.
Corkwood	(t)	Hakea divaricata
Cotton bush	(s)	Maireana aphylla
Cotton-panic grass	(pg)	Digitaria brownii
Couch grass	(pg)	Cynodon dactylon
Curious saltbush	(f)	Dissocarpus paradoxus
Curly windmill grass	(pg)	Enteropogon acicularis
Dead finish	(s)	Acacia tetragonophylla
Desert bluegrass	(pg)	Bothriochloa ewartiana
Desert oak	(t)	Allocasuarina decaisneana
Eight-day grass	(pg)	Fimbristylis dichotoma
Emubush	(s)	Eremophilla longifolia
Fairy grass (Yakka grass)	(ag)	Sporobolus caroli
Fire bush	(s)	Cassia pleurocarpa
Five-minute grass	(pg)	Tripogon loliiformis
Flinders grass	(ag)	Iseilema spp.
Frankenia	(s)	Frankenia sp.
Fuchsia	(s)	Eremophilla spp.
Galvanised burr	(f)	Scerolaena birchii
Gidyea	(t)	Acacia georginae
Goathead burr	(f)	Sclerolaena bicornis
Grevillea	(s)	Grevillia spp.
Grey germander	(s)	Teucrium racemosum

Harlequin fuchsia	(s)	Eremophilla duttonii
Hop bush	(s)	Dodonaea viscosa
Ironwood	(t)	Acacia estrophiolata
Kangaroo grass	(pg)	Themeda triandra
Katoora	(pg)	Sporobolus actinocladus
Kerosene grass	(pg or ag)	Aristida browniana
Lifesaver burr	(f)	Sida platycalyx
Lignum	(s)	Muehlenbeckia cunninghamii
Limestone oat grass	(pg or ag)	Enneapogon cylindricus
Mallee	(t)	Eucalyptus spp.
Mitchell grass	(pg)	Astrebla spp.
Mountain wandarrie	(pg)	Eriachne mucronata
Mulga	(t)	Acacia aneura
Mulga grass	(ag or pg)	Aristida contorta
Mulga Mitchell grass	(pg)	Thyridolepis mitchelliava
Munyeroo (Pigweed)	(f)	Portulaca oleracea
Myall	(s)	Acacia calcicola
Nardoo	(f)	Marsillea drummondii
Native Millet	(pg)	Panicum decompositum
Needlewood	(t)	Hakea suberea
Neverfail	(pg)	Eragrostis setifolia
Northern bluebush	(s)	Chenopodium auricomum
Oatgrass	(ag or pg)	Enneapogon avenaceus
Old man saltbush	(s)	Atriplex nummularia
Onion weed	(f)	Asphodelus fistulosus
Oval leaf cassia	(s)	Cassia oligophylla
Paddy melon	(f)	Cucumis colocynthis
Paper daisy	(f)	Helipterum floribundum
Parakeelya	(f)	Calandrinia spp.
Paterson's curse	(f)	Echium lycopsis
Pepper grass	(pg)	Panicum whitei
Pituri	(f)	Nicotiana sp.
Poached-egg daisy	(f)	Myriocephalus stuartii
Prickly wattle (Acacia bush)	(t)	Acacia victoriae
Purple plumegrass	(ag or pg)	Triraphis mollis
Pussytails	(f)	Ptilotus spp.
Rhyncosia	(f)	Rhyncosia minima
River redgum	(t)	Eucalyptus camaldulensis
Rock fuchsia	(s)	Eremophilla duttonii
Saffron thistle	(f)	Carthanmus lanatus
Samphire	(s)	Halosarcia pergranulata
Sandhill canegrass	(pg)	Zygochloa paradoxa
Sandhill wattle	(s)	Acacia dictyophleba
Satiny bluebush	(s)	Maireana georgei
Sickle love grass	(pg)	Eragrostis falcata
Sida	(f)	Sida spp.
Silky browntop	(pg)	Eulalia fulva

Smokebush	(f)	Ptilotus obovatus
Spinifex	(pg)	Triodia spp and Plectrachne spp
Spiked malvastrum	(f)	Malvastrum americanum
Stinkweed (Apple bush)	(f)	Pterocaulon sphacelatum
Summer grasses	(ag or pg)	Brachiaria spp
Supplejack	(t)	Ventilago viminalis
Swainsona	(f)	Swainsona spp.

t = tree
s = shrub
pg = perennial grass
ag = annual grass
f = forb

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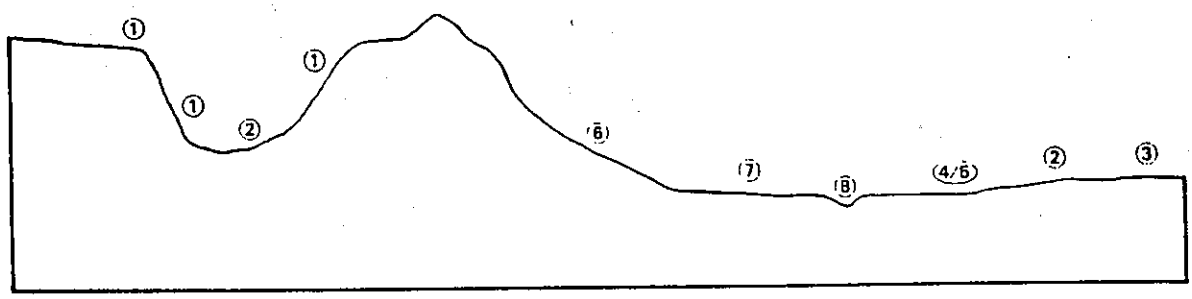
PEEBLES (Pe) LAND SYSTEM (510 km²)

Broken and undulating plains and steep hills fringing the Goyder Creek.



UNIT	PASTURE TYPE	EXTENT	LANDFORM	SOILS	VEGETATION
1	RIDGES AND VALES (Low productivity)	Medium	Broken plateaux and breakaways	Shallow rocky and stony soils.	Sparse mulga and low shrubs over sparse unpalatable grasses.
			Vales between ridges	Shallow stony soils and aeolian sands.	Mulga, broombush and other shrubs over kerosene grass, woollybutt, mulga grass and forbs.
2	MULGA ANNUAL (Moderate productivity)	Medium	Alluvial plains	Red sandy clay loams with laterite and ironstone gravel.	Mulga and low shrubs (broombush, turkey bush) over mulga grass and oat grass with minor woollybutt, cotton panic grass, sidas, copperburrs and other forbs.
			Erosional slopes	Stony and gravelly red sandy clay loams.	
3	MULGA PERENNIAL (Low productivity)	Medium	Alluvial plains.	Red earths with laterite and ironstone gravel.	Groved mulga and low shrubs (broombush, turkey bush) over woollybutt, bandicoot grass, mulga Mitchell grass and minor mulga grass, oat grass and forbs.
4	OPEN WOODLAND (Moderate productivity)	Small	Alluvial plain	Red brown sandy clay loams.	Open ironwood, mulga, witchetty bush and needle-wood over oat grass with minor mulga grass, umbrella grass, curly windmill grass and forbs.
5	SANDY OPEN WOODLAND (Moderate productivity)	Small	Alluvial plain	Loamy sands and sandy loams.	Open ironwood, mulga, prickly wattle and needle-wood over kerosene grass, oat grass, minor woollybutt and forbs.

Only small areas of the lower, more accessible parts of Rumbulara land system are currently grazed. Very small areas of the more preferred pasture types close to water are intensively grazed and in poor to fair condition.

Reasonably extensive lower areas of the land system are currently not grazed and could be developed to carry breeders at continuous low stocking rates or be used for seasonal fattening. The clayey stony slope, open woodland, saltbush slope and bluebush rise pasture types require careful management to prevent loss of palatable grasses and initiation of accelerated erosion through reduced cover and rilling of cattle pads and poorly located tracks.

Higher stony plateaux and rises are sparingly grazed during droughts.