

# Barkly District



Understanding the productivity of grazing lands

## Land Condition Guide



CARING  
FOR  
OUR  
COUNTRY



Northern Territory  
Government



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Further information on land condition can be found through the Grazing Land Management (GLM) workshops. For information about the GLM courses available in the Northern Territory please contact the Department of Resources on 8973 9763.

# Land Condition Guide

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# Land Condition Guide

## Introduction

This booklet is a pastoral land condition assessment tool that has been produced to assist land managers.

Land condition can be described as the ability of land to respond to rainfall and produce useful forage. Country in good condition is robust and can recover quickly from stresses such as grazing, fire or a few dry years.

Land in poor condition is lacking in productive perennial pastures and is often affected by soil erosion due to a decline in ground cover and the stabilising effects of perennial grass tussocks and roots.

Often land is somewhere between good and poor condition where pastures are in some state of decline or soil condition is starting to deteriorate. It is important to understand what processes are causing the decline so that changes in management can be implemented before land condition declines further.



Good condition 
→
 Poor condition

To assess a given area for land condition we look at FOUR major features of the landscape: pasture structure and composition, soil condition, presence of weeds and woodland structure. Table 1 outlines how these features change with varying land condition states and what criteria must be met to assign an area to a land condition group.

Land condition is divided into 4 categories A, B, C and D condition with A condition being the best and D condition the worst.

**Table 1**

Land Condition	Soil	Pasture	Weed	Woodland
<b>A</b> (All of these features)	No erosion and good surface condition	Good coverage of 3P grasses*, little bare ground (<30%) in most years	Few weeds and no significant infestations	No signs of woodland thickening
<b>B</b> (At least one or more of these features)	Some signs of previous erosion and some current signs of erosion risk	Some decline in the presence of 3P grasses and/or bare ground (more than 30%, but less than 50% in most years)	Small infestations of weeds	Some thickening in the density of woody plants
<b>C</b> (One or more of these features)	Obvious signs of past erosion and/or current susceptibility to erosion	General decline in the presence of 3P species and/or bare ground (>50% in most years)	Obvious presence of weeds	General thickening in the density of woody plants
<b>D</b> (One or more of these features)	Severe erosion, scalding or compaction resulting in a hostile environment for plant growth	General lack of any perennial grasses or forbs	Large weed infestations covering significant areas	Thickets of woody plants that cover significant areas

\*3P grasses = Palatable, Productive Perennial grasses

# Soil

Good soil condition is important for healthy plant growth. The uppermost layer of the soil is known as top soil or the A horizon. This layer is anywhere from a few cm to 20+ cm deep and is where seed germination occurs and plants concentrate their roots for stability and nutrient uptake. When top soil is eroded, plants struggle to establish which leads to less ground cover and subsequently higher rates of runoff, reduced infiltration of rain water and further erosion.

The key to maintaining soil condition is good plant cover. Plant tussocks and leaf litter provide barriers which slow the velocity of water and wind and reduce resource loss from the system.

## Types of soil erosion

These are some of the erosional processes that may occur in land with declining land condition.

### Rills and Gullies

Channels cut upslope by flowing water, often initiated by water flowing down a cattle pad, fence line or road.

### Terracettes

Small abrupt walls 1-10cm high cut into the slope and aligned with the contour.

### Sheeting or sheet erosion

Progressive removal of thin layers of soil across extensive areas.

### Scalding

The loss of A horizon material to expose a hard-setting subsurface horizon.

### Hummocking

Confined to soils with coarse textured surface layers such as sand and is the result of accumulation of wind borne material around obstructions.

### Pedestalling

Removal of soil from around obstructions (commonly plants) to leave them perched on a mound above the surrounding soil surface.



Rill erosion



Sheet erosion



Pedestalling erosion

# Pasture

The presence of palatable productive perennial grasses (3P's) in most cases indicates good land condition. These species are the first to disappear under heavy grazing and are often replaced by less productive grasses and forbs. Carrying capacity is therefore reduced because there is less palatable forage for stock.

Some land types such as those dominated by spinifex don't typically meet the 3P grass criteria for good land condition. While spinifex is not as productive or palatable as other 3P grasses, it is perennial and can facilitate good land condition when other land condition components are maintained.

Areas of land in good condition have healthy soils that provide water and nutrients for plants to grow. In return, the plants help protect the soil and return nutrients through decomposing leaf litter. Carbon is also captured and stored effectively where good land condition occurs. When land condition declines, the cycle is broken and resources such as nutrients and water are lost from the system.



The solid lines represent the movement of resources such as nutrients, water or vegetative cover such as leaves. The dashed lines show how the grass tussocks encourage the retention of these resources so they remain available to the surrounding plants.



Land in poor condition often has wide spaces between grass tussocks which allow resources to leave the local ecosystem. More bare ground also leads to greater rates of erosion by wind and water which accelerates the decline in land condition.

A modification in grazing strategies can assist in improving pasture condition. Wet season spelling, rotational grazing and stocking rate adjustments can encourage the re-establishment of preferentially grazed pasture species and increase ground cover.

Strategic burning can also be used to manage pastures by removing rank growth and modifying grazing distribution. In the Barkly, a low-moderate intensity fire after rain at the beginning of the wet season is recommended for black soil pastures to improve pasture quality and encourage more even grazing as cattle will be less selective when grazing new growth. At least 1500kg/ha is required to successfully burn under these conditions.

Annual-dominated pastures do not respond well to fire. As annual species only live for one year, a fire can completely remove ground cover until the next rains occur and seeds are germinated. If fire occurs before the annual species have set seed then the seed bank is depleted and even good rain may not produce much forage.

# Weeds and woody thickening

A decline in land condition is not always a decline in vegetative growth. A weed infestation or woody thickening will also decrease land condition while maintaining some of the “good” condition characteristics such as ground cover. However weeds and woody thickening can have a large impact on land condition because they require more intensive and expensive management techniques to rectify.

Weeds, trees and shrubs in large numbers affect land condition by competing with pastures for nutrients, water and sunlight. Minor weed infestations or woody thickening can quickly spread to dominate the landscape, inhibiting pasture growth and making them less viable for cattle production.

Fire can be used to kill or suppress tree growth when fuel loads are upwards of 2000kg/ha and the species are sensitive to fire. For fire to be effective, trees need to be less than 200cm tall and ground cover must be greater than 40-50%. A fire frequency of 5-10 years is recommended so that re-sprouting woody plants don't become too tall before the next burn. Where woody thickening is already a problem, fuel loads upwards of 3500kg/ha may be required for successful woody control.

Not all land types respond well to fire. Burning annual-dominated pastures lead to exposed soils and reduced seed banks. Spinifex is also sensitive to fire in drier areas and a late dry season fire may kill the plant.

Other options for woody thickening and weed control include chemical and/or mechanical treatments however prevention is the most successful and cost effective control method.

Weeds of significance in the Barkly region include:

- Prickly acacia
- Parkinsonia
- Mesquite
- Rubber bush
- Noogoora burr
- Bellyache bush
- Needle bush (Mimosa bush)
- Mossman river grass
- Khaki weed



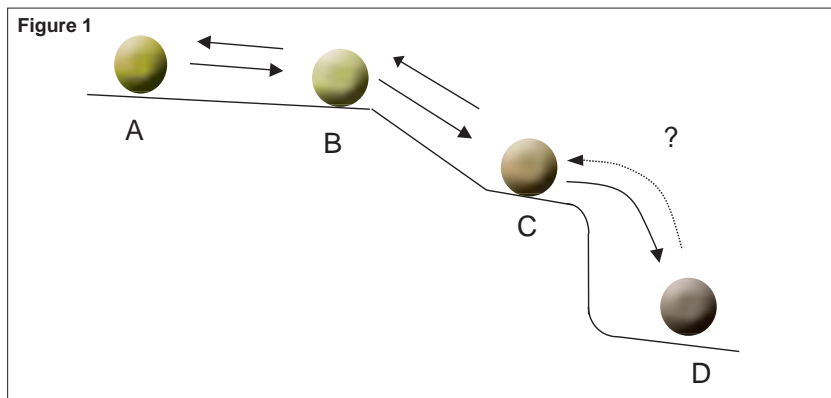
**Parkinsonia on Barkly land system**



**Rubberbush on Barkly land system**

# The ABCD Land Condition Framework

The ABCD land condition framework provides land managers with a standardised approach for assessing the capacity of their land to respond to rainfall.



In the ABCD framework, land condition can be represented by a ball sitting on a slope. The further the ball travels down the slope, the poorer the land condition. The slope of the line represents the relative management effort required to reverse the change in land condition. As land condition declines, the slope becomes steeper which makes improving land condition more labour intensive, expensive and time consuming the further it declines.

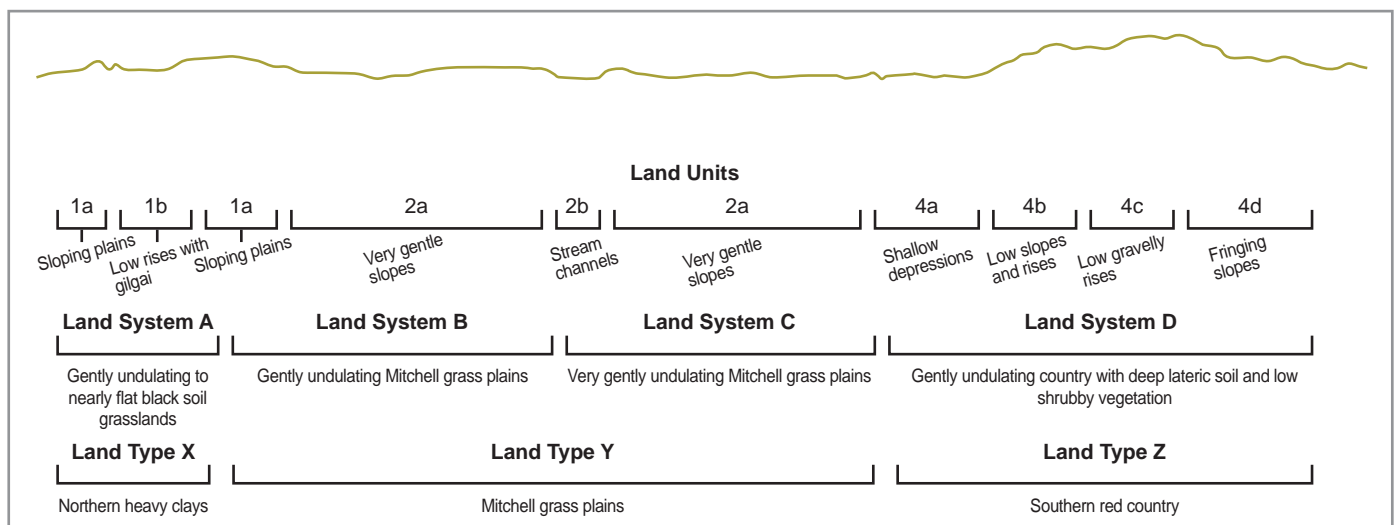
Land in 'A' condition is relatively stable. Land that is trending towards 'B' condition can be fairly quickly reverted to 'A' by small changes in management.

However, land in 'B' condition is susceptible to a quick decline to 'C' condition. Reversing this change may require more significant changes in management and will take some time to occur.

Land in 'C' condition is very susceptible to falling rapidly to 'D' condition. Land in 'D' condition will not revert to 'C' condition by simply changing management, at least not in any time frame of practical interest to grazing land management. Improving land in 'D' condition to 'C' condition requires a large input of external energy (mechanical and/or chemical), and even this may be insufficient if soil condition has been severely damaged.

## Understanding land systems

The term 'land system' describes areas of similar soil and vegetation patterns. Land systems are widely used and referred to because they have been quantified by field surveys and mapping. 'Land units' are a more detailed measure of land systems and describe unique areas of specific soils and vegetation. Each land system usually contains a number of land units.



'Land type' is another term commonly used and it refers to specific soil and vegetation features. These are more commonly 'layman's' terms and often are described by the dominant soil, tree or pasture species, for example Mitchell grass country or Spinifex on northern red soils. They are generally broad and can occur over a number of land systems. For example, Barkly and Austral are different land systems due to the nature of their geology, but are both the same land type; Mitchell grass country.



# Using this guide

This guide includes information on pasture growth and carrying capacity for a selection of land systems in the region. Above the land system name is a general land type description. This will help you identify which pages are most suitable to land systems not mentioned in the booklet.

Use the land system photos in conjunction with the land condition assessment table on page 2 to help you identify your pastures and what condition they are in.

A Condition	
Recommended utilisation rate	20%
Pasture growth expected in 50% of years	850 - 2200 kg/ha
Desirable species %	>80%
Carrying Capacity (AE's/km <sup>2</sup> )	4.5 - 12

Utilisation rate is the proportion of pasture growth that can be consumed while maintaining good land condition.

Pasture growth values are based on median annual rainfall (the expected annual rainfall in 50% of years). Annual rainfall can vary within a region, and this will affect how much pasture grows. Where this is the case a range of expected pasture growth values have been given that represent the lowest to the highest across the region that the land system occurs in.

Carrying capacity is the average long term stocking rate that can be carried safely. Because of differences in average rainfall across geographical areas a range of expected pasture growths have been used in the calculations.

$$\frac{\text{Pasture growth} * \text{Utilisation rate} * 100}{\text{Forage demand}}$$

(times by 100 is conversion from ha to km<sup>2</sup>)

Forage demand = annual animal intake per AE (3650kg/year)

AE = Adult equivalent (One AE = One 450kg dry cow)

Carrying capacity is expressed as AE's /km<sup>2</sup>

# Carrying capacity assumptions and notes

Long term carrying capacity is the average number of animals that a paddock can be expected to support over a planning horizon (5-10 years) without affecting land condition.

Pasture growth estimates have been calculated using models created from data collected from monitoring sites across the NT.

Carrying capacity figures assume all land is within 3-5km of water (depending on terrain).

Discounts for pasture growth for land condition changes have been calculated using GLM principles

**Table 2**

Land Condition	Discount applied to pasture growth	Land Condition	Discount applied to pasture growth
A	100% of A condition pasture growth	C	45% of A condition pasture growth
B	75% of A condition pasture growth	D	20% of A condition pasture growth

Pasture growth may vary outside of the given ranges depending on the type of land condition decline you have. Where high yielding weeds and undesirable plants invade, pasture growth values may actually be higher but the overall productivity of useful forage or carrying capacity would be reduced.

Utilisation rates are based on research work conducted across northern Australia. As a general rule, recommended utilisation rates are 20% for robust black soils, 15% for productive red soils with perennial grasses, 10% for poorer red soils with a mix of less palatable perennial and annual grasses and 5% for spinifex dominated land types.

Utilisation rate recommendations and carrying capacity figures have been excluded for land in D condition. While pastures in this condition can grow limited grass, it is not recommended that these areas be grazed until land condition can be improved.

# Mitchell grass country

## Barkly land system



### Dominant Pastures

Barley mitchell (*Astrelba pectinata*)  
Weeping mitchell (*Astrelba elymoides*)

### Other Pastures

Bull mitchell (*Astrelba squarrosa*)  
Flinders grasses (*Iseilema* species)  
Feathertop wiregrass (*Aristida latifolia*)  
Native couch (*Brachyachne convergens*)  
Golden beard grass (*Chrysopogon fallax*)  
Pepper grass (*Panicum laevinode*)  
Flemings bush (*Flemingia pauciflora*)

### Other Shrubs

Acacia bush (*Acacia victoriae*)  
Conkerberry (*Carissa lanceolata*)

### Other Trees

Coolibah (*Eucalyptus microtheca*)  
Beefwood (*Grevillea striata*)  
Barklys wattle (*Vachellia sutherlandii*)  
Georgina wattle (*Acacia georginae*)  
Gidgee (*Acacia cambagei*)

### Description

Very gently undulating, heavy grey clays. Surface has a light covering of chert pebbles in some areas. Barkly landsystem is divided into 3 parts (see map inside back cover). The only difference between Barkly 1, 2 and 3 is the amount of chert pebble on the surface (B1 = least, B3 = most).

### Pastoral Value

High pastoral value.

### Management Implications

This land system is resilient to both grazing and fire. Moderate to poor quality hay production is possible.



## A Condition

Recommended utilisation rate
20%
Pasture growth expected in 50% of years
850 – 2200 kg/ha
Desirable species %
>80%
Carrying Capacity (AE's/km <sup>2</sup> )
4.5 - 12



## B Condition

Recommended utilisation rate
20%
Pasture growth expected in 50% of years
650 – 1400 kg/ha
Desirable species %
50 – 80%
Carrying Capacity (AE's/km <sup>2</sup> )
3.5 – 7.5



## C Condition

Recommended utilisation rate
20%
Pasture growth expected in 50% of years
400 – 850 kg/ha
Desirable species %
25 – 50%
Carrying Capacity (AE's/km <sup>2</sup> )
2 – 4.5



## D Condition

Recommended utilisation rate
0%
Pasture growth expected in 50% of years
150 – 350 kg/ha
Desirable species %
0 – 25%
Carrying Capacity (AE's/km <sup>2</sup> )
0

# Northern heavy clays

## Creswell land system



### Description

Very gently undulating heavy grey pedocals with gilgais confined to the northern parts of the Barkly.

### Pastoral Value

Moderate to high pastoral value.

### Management Implications

Strategic burning can improve palatability of dense stands of Silky Browntop (*Eulalia aurea*). Overgrazed areas near water points can benefit from wet season spelling.

#### Dominant Pastures

Silky browntop (*Eulalia aurea*)  
Curly bluegrass (*Dichanthium fecundum*)  
Golden beard grass (*Chrysopogon fallax*)

#### Other Pastures

Bull mitchell (*Astrebla squarrosa*)  
Feathertop wiregrass (*Aristida latifolia*)  
Native millet (*Panicum decompositum*)  
Barley mitchell (*Astrebla pectinata*)  
Weeping mitchell (*Astrebla elymoides*)  
Annual sorghum (*Sorghum timorense*)  
Sensitive plant (*Neptunia* species)

#### Other Trees

Coolibah (*Eucalyptus microtheca*)



**A Condition**

Recommended utilisation rate	20%
Pasture growth expected in 50% of years	1650 – 2150 kg/ha
Desirable species %	>80%
Carrying Capacity (AE's/km <sup>2</sup> )	9 – 12



**B Condition**

Recommended utilisation rate	20%
Pasture growth expected in 50% of years	1250 – 1600 kg/ha
Desirable species %	50 – 80%
Carrying Capacity (AE's/km <sup>2</sup> )	7 – 8



**C Condition**

Recommended utilisation rate	20%
Pasture growth expected in 50% of years	750 – 950 kg/ha
Desirable species %	25 – 50%
Carrying Capacity (AE's/km <sup>2</sup> )	4 – 5



**D Condition**

Recommended utilisation rate	0%
Pasture growth expected in 50% of years	350 – 450 kg/ha
Desirable species %	0 – 25%
Carrying Capacity (AE's/km <sup>2</sup> )	0

# Spinifex on northern red soils

## Pollyarra land system



### Dominant Pastures

Soft spinifex (*Triodia pungens*)

### Other Pastures

Golden beard grass (*Chrysopogon fallax*)

Lemon grass (*Cymbopogon bombycinus*)

Gulf wiregrass (*Aristida pruinosa*)

Silky browntop (*Eulalia aurea*)

### Dominant Shrubs

Turpentine (*Acacia lysiphloia*)

Hill turpentine (*Acacia monticola*)

Wattle (*Acacia argyraea*)

Candelabra wattle (*Acacia coleii*)

### Dominant Trees

Variable-bark bloodwood (*Corymbia dichromophloia*)

Snappy gum (*Eucalyptus leucophloia*)

### Other Trees

Beefwood (*Grevillea striata*)

Ironwood (*Erythrophleum chlorostachys*)

### Description

Gently undulating, shallow, gravelly red earths confined to the northern parts of the Barkly.

### Pastoral Value

Low pastoral value.

### Management Implications

Early dry season burning may improve pasture palatability to livestock and reduce the risk of wildfires.



## A Condition

Recommended utilisation rate	5%
Pasture growth expected in 50% of years	1100 kg/ha
Desirable species %	>80%
Carrying Capacity (AE's/km <sup>2</sup> )	1.5



## B Condition

Recommended utilisation rate	5%
Pasture growth expected in 50% of years	850 kg/ha
Desirable species %	50 – 80%
Carrying Capacity (AE's/km <sup>2</sup> )	1



## C Condition

Recommended utilisation rate	5%
Pasture growth expected in 50% of years	500 kg/ha
Desirable species %	25 – 50%
Carrying Capacity (AE's/km <sup>2</sup> )	0.5

No image available



## D Condition

Recommended utilisation rate	0%
Pasture growth expected in 50% of years	200 kg/ha
Desirable species %	0 – 25%
Carrying Capacity (AE's/km <sup>2</sup> )	0

# Southern red country

## Wonorah land system



### Dominant Pastures

Soft spinifex (*Triodia pungens*)  
Gulf wiregrass (*Aristida pruinosa*)  
Kerosene grass (*Aristida hygrometrica*)  
Silky browntop (*Eulalia aurea*)  
Ribbon grass (*Chrysopogon fallax*)  
Kangaroo grass (*Themeda triandra*)  
White grass (*Sehima nervosum*)

### Dominant Shrubs

Candelabra wattle (*Acacia coleii*)  
Turpentine (*Acacia lysiphloia*)  
Hill turpentine (*Acacia monticola*)  
Broom wattle (*Acacia tenuissima*)  
Conkerberry (*Carissa lanceolata*)

### Dominant Trees

Snappy gum (*Eucalyptus leucophloia*)  
Variable-bark bloodwood (*Corymbia dichromophloia*)  
Inland bloodwood (*Corymbia terminalis*)  
Silver box (*Eucalyptus pruinosa*)  
Glossy-leaf box (*Eucalyptus chlorophylla*)

### Other Trees

Beefwood (*Grevillea striata*)  
Supplejack (*Ventilago viminalis*)  
Whitewood (*Atalaya hemiglauca*)

### Description

Gently undulating, deep lateritic red earths with low scrubby vegetation in the central and southern parts of the Barkly region.

### Pastoral Value

Low to moderate pastoral value. Most valuable for wet season grazing when surrounding heavier soils are saturated.

### Management Implications

Good area for cattle during the wet season, but need to ensure areas of red soil are large enough within the paddock to accommodate all the herd, or overgrazing during the wet will result in rapid land condition decline.





## A Condition

Recommended utilisation rate	10%
Pasture growth expected in 50% of years	1000 – 2450 kg/ha
Desirable species %	>80%
Carrying Capacity (AE's/km <sup>2</sup> )	2.5 – 6.5



## B Condition

Recommended utilisation rate	10%
Pasture growth expected in 50% of years	750 – 1850 kg/ha
Desirable species %	50 – 80%
Carrying Capacity (AE's/km <sup>2</sup> )	2 – 5



## C Condition

Recommended utilisation rate	10%
Pasture growth expected in 50% of years	450 – 1100 kg/ha
Desirable species %	25 – 50%
Carrying Capacity (AE's/km <sup>2</sup> )	1 – 3



## D Condition

Recommended utilisation rate	0%
Pasture growth expected in 50% of years	200 - 500 kg/ha
Desirable species %	0 - 25%
Carrying Capacity (AE's/km <sup>2</sup> )	0

# Grazing Land Management

# Species list

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## Barkly

### Desirable Perennial Grasses

Barley mitchell grass	<i>Astrebla pectinata</i>
Bull mitchell grass	<i>Astrebla squarrosa</i>
Weeping/Hoop mitchell grass	<i>Astrebla elymoides</i>
Golden beard grass	<i>Chrysopogon fallax</i>
Silky browntop	<i>Eulalia aurea</i>
Curly bluegrass	<i>Dicanthium fecundum</i>
Native millet	<i>Panicum decompositum</i>
Kangaroo grass	<i>Themeda triandra</i>

### Desirable Annual Grasses

Flinders grass	<i>Iseilema species</i>
Native couch	<i>Brachyachne convergens</i>
Oatgrass	<i>Enneapogon polyphyllus</i>

### Desirable Legumes/forbs

Sensitive plant	<i>Neptunia species</i>
Rhynchosia	<i>Rhynchosia minima</i>
Pea bush	<i>Sesbania cannabina</i>
Onion vine	<i>Operculina aequisepala</i>
Fringed glycine	<i>Glycine falcata</i>

### Intermediate value grasses (perennials and annuals)

Soft spinifex	<i>Triodia pungens</i>
Lemon grass / Silky oil grass	<i>Cymbopogon bombycinus</i>
White grass	<i>Sehima nervosum</i>
Pepper grass	<i>Panicum laevinode</i>
Fairy grass	<i>Sporobolus australasicus</i>

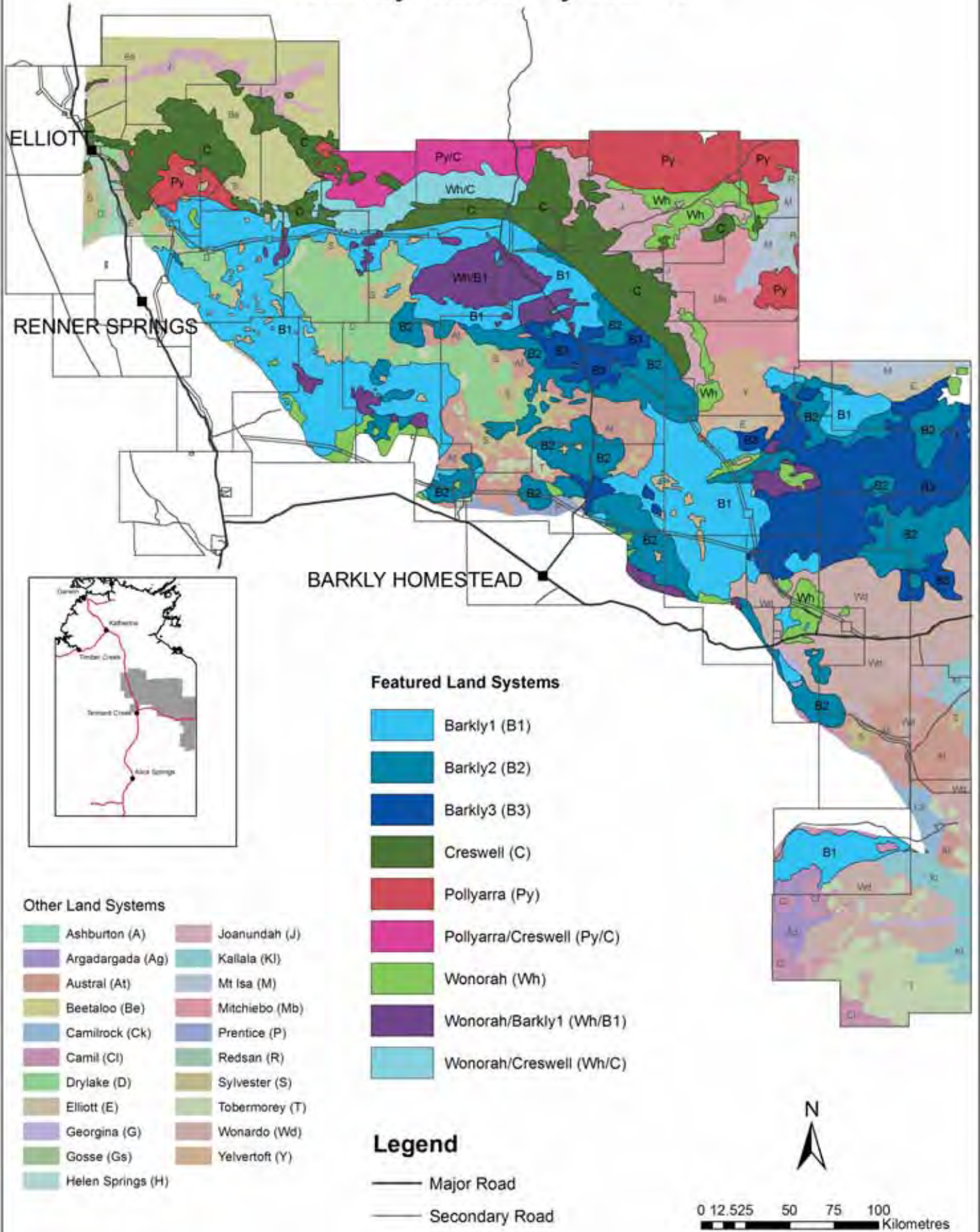
### Less desirable grasses (perennials and annuals)

Gulf wiregrass	<i>Aristida pruinosa</i>
Feathertop wiregrass	<i>Aristida latifolia</i>
Annual sorghum	<i>Sorghum timorense</i>
Kerosene grass	<i>Aristida hygrometrica</i>

### Less desirable forbs

Fleming's bush	<i>Flemingia pauciflora</i>
Sedge	<i>Cyperus species</i>
Sida	<i>Sida species</i>
Rattlepod	<i>Crotalaria species</i>
Flinders river poison	<i>Tephrosia rosea</i>

# Barkly Land Systems



Infrastructure and Cadastre data supplied by the NT Department of Planning and Infrastructure.  
 Land System data supplied by the NT Department of Natural Resources, Environment, The Arts and Sport.

Map produced by Desert Wildlife Services. Technical Enquiries: 08 89521696

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