

# Managing mitchell grass

a grazier's guide

Ian Partridge



Q196009

**DPI**  
QUEENSLAND

Information Series Q196009

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Department of Primary Industries  
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**Information Series QI96009**

**ISSN 0727-6273**

**ISBN 0 7242 5968 6**

**First published 1996**

**This book has been published with funding  
from the**



**NATIONAL  
LANDCARE  
PROGRAM**

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Department of Primary Industries  
GPO Box 46  
Brisbane Q 4001

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# Contributors

The information in this booklet comes from a wide range of sources—from local graziers through discussions with Local Best Practice and from many officers of the Department of Primary Industries and CSIRO Division of Tropical Crops and Pastures.

The following people have contributed most of the information and many of the ideas:

Jenny Milson	Errol Weston
Dr Richard Silcock	Trevor Hall
Dr David Orr	David Phelps
Dr Piet Filet	David Lawrence
John Reynolds	John Carter
David Cobon	Peter Johnson
Aleksi Bogusiak	Desire Bowden
Keith Muller	Sonya Muller
Bob Cottam	Peter Knights
Dr Lester Pahl	Peter Jeffrey
Dr John Tothill	Mike Sullivan

## Acknowledgments

I thank Jenny Milson, Trevor Hall, David Phelps, John Reynolds, David Gramshaw, Warwick Baxter, Aleksi Bogusiak, David Orr, Geoff Knights, Peter Johnston, Peter Connelly, Piet Filet, Vic French, Jenny Carter, Tony Grice, Joel Brown, Sue Cottam of Sue Cottam Productions and Naturally Queensland Photo Library of the Department of Environment and Heritage for permission to reproduce their photographs.

I thank Dr Brian Roberts of the Land Use Study Centre, University of Southern Queensland for permission to use line drawings by Gillian Scott from *Western Grasses: a Grazier's Guide to the Grasses of South West Queensland*.



# Preface

Successful graziers are successful because of their expertise in managing their livestock. Income from these livestock provides for the needs of the family and for future development of the property.

Most of these livestock will eat native pastures for all of their lives. However, even if stock are in good condition, it does not necessarily follow that the pasture is. A recent survey suggests that only a third of the total area of native pasture in Queensland is in top condition, the rest is under some sort of stress—a small area has been degraded too far to be recovered economically. Fortunately the mitchell grasslands are generally in better condition than some of the other grasslands.

The condition of this native pasture resource is of vital importance to the long-term profitability and efficiency of each property, and hence of the pastoral industry as a whole.

While poor condition in most other grasslands has been due to overgrazing and a loss of key desirable grasses, poor condition in the more resilient mitchell grasslands is due more to invasion by woody weeds in the north, increasing white speargrass in the south-west, and feathertop in the central west.

The federal and state governments regard protection and maintenance of our natural resources as one of their more important functions. Commonwealth programs through the National Landcare Program and state programs through the Department of Primary Industries seek to help graziers to protect their asset for the present and future.

Property Management Planning plays a major part in the efficient use of the land. Whole property management involves planning for all aspects of the entire property—land, vegetation, livestock and finances; it must be backed up with suitable information and guidelines on the management of each aspect.

This book concentrates on the plant side of the livestock industry; I hope it will help you by:

- bringing together the knowledge that you already have
- telling you about management practices being developed through research
- stimulating more interest in what is happening in your pastures.



# In a nut shell

Mitchell grass pastures are a valuable and stable resource; they provide good quality grazing, and are able to recover well from drought and short-term over-use. Although mitchell grass is resilient, the pastures can deteriorate if other species become predominant.

There are no fixed recipes for managing mitchell grass pastures; instead you need

- to understand how the different plants and grazing animals affect each other
- to have some practical local guidelines
- to look closely at the plants on the ground.

Mitchell grass will last for ever under continuous grazing if stocking rates are adjusted appropriately. This adjustment should be made at the end of the growing season, and based on the amount of feed standing in the paddock.

Do not graze mitchell grass plants below 10 cm in height and allow them to recover after defoliation. Heavy grazing after a drought, floods or a fire will weaken mitchell grass.

Mitchell grass is not normally burned because the standing hay is of fair quality and it is too valuable in a region with typically unreliable rainfall.

## Northern region

Woody weeds, especially prickly acacia and algaroba, are the greatest threat.

**By the time you recognise a woody weed problem, it's probably too late.**

Grazing management should be directed towards controlling the woody weeds and preventing the spread of their seed. Water points must be well distributed and, in many areas, kangaroos must be managed or their numbers controlled.

Feathertop in the north increases in wet years but decreases in the dry ones.

## Southern region

The main problems are the seeds of grasses which downgrade wool and can damage sheep.

White speargrass increases under constant heavy grazing especially with sheep whereas feathertop increases under light grazing with sheep after wet summers.

Both white speargrass and feathertop are susceptible to defoliation while growing actively, and may be reduced by:

- crash grazing with cattle for 1–2 months at the start of the growing season
- burning in spring
- baling.

On land that can be cropped, severely degraded pastures can be ploughed out and reseeded with mitchell grass seed after a number of years of crop.

Running both sheep and cattle makes better use of mitchell grass pastures.

# Introduction

## The aim—production with care

Good grazing management aims to achieve a level of production that can be maintained over decades—without the pasture condition deteriorating because woody and weedy species increase, productive grass species disappear or the soil washes away.

Pastures in poorer condition may be able to be restored with suitable management practices—and reasonable rainfall.

## No fixed recipes

Managing native pastures well is not always as simple as it looks—it needs some special skills. Rainfall varies from droughts to floods, herds and flocks take years to build up, and costs have to be kept down. Your pastures can change significantly with management and variable rainfall over a period of a few years.

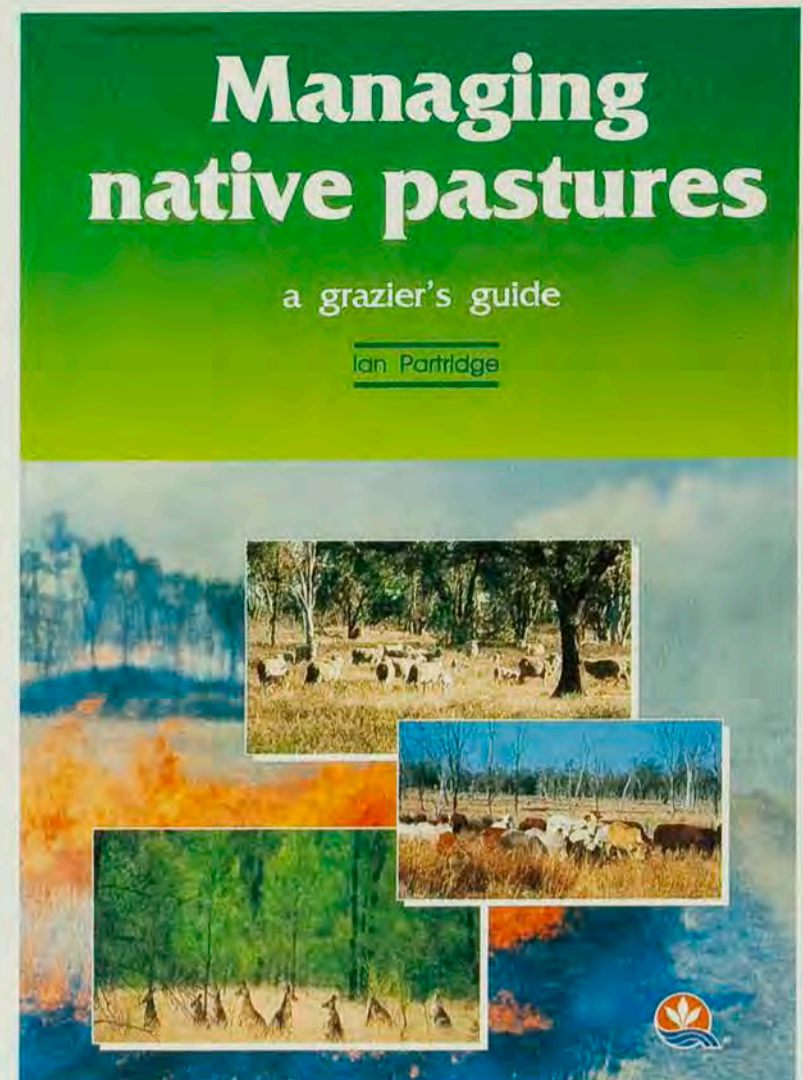
There can be no fixed recipes for managing native pastures—unlike the management of crops or intensive sown pastures. Rather you need:

- to understand how grasses, trees, soils, grazing animals and climate affect each other—their ecology
- to follow some practical local guidelines which are based on experience and research
- to check—monitor—gradual changes or fluctuations that may occur in your pasture.

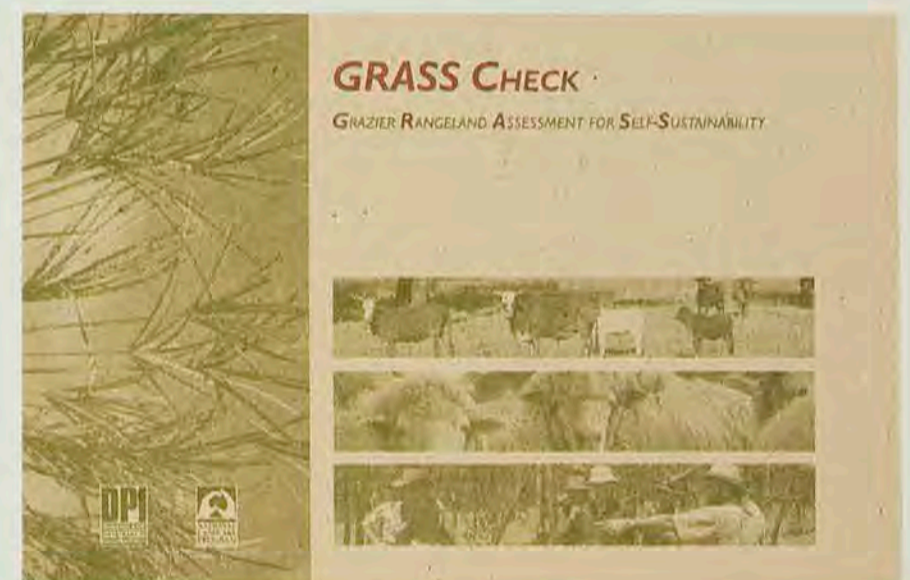
The basic principles of native pasture ecology have been described in ***Managing native pastures: a grazier's guide***. Methods of monitoring are described in a separate DPI publication **GRASS Check**.

This book provides the general guidelines for managing your mitchell grass country; it also helps you to identify some important grass species. Many other species can be identified with ***Plant identification in the arid zone*** and ***Plants of southern inland Queensland***.

You probably already know most of the individual guidelines, but this book tries to help you bring them together to devise good grazing management strategies. It may further stimulate your interest so that you will give management of your native pastures equal consideration to the management of your livestock.



*describes the general principles of grazing management and ecology*



*describes how to monitor pastures*





*Mitchell grass is the largest productive grassland in northern Australia*



*Deep cracking clay soils of the mitchell grass downs*

## Mitchell grass

Mitchell grass (*Astrebla* species) occurs in a broad arc of low (250 to 550 mm) rainfall country from the Kimberley region of Western Australia to a latitude of about 32°S in New South Wales—a total area of about 30 million hectares. It is the largest extensive grazing resource in semi-arid Queensland, and the largest productive pasture community in the Northern Territory and northern Western Australia.

### The downs

Mitchell grass is the main species of the sparsely timbered rolling downs of western Queensland where it grows on moderately fertile, cracking clay soils; in southern Queensland, it also grows on alluvial plains.

Mitchell grass is also found on ashy, stony or pebbly downs further west around Boulia and Windorah. These areas have even more marginal rainfall, averaging less than 250 mm, and the soils have poor water-holding capacity.

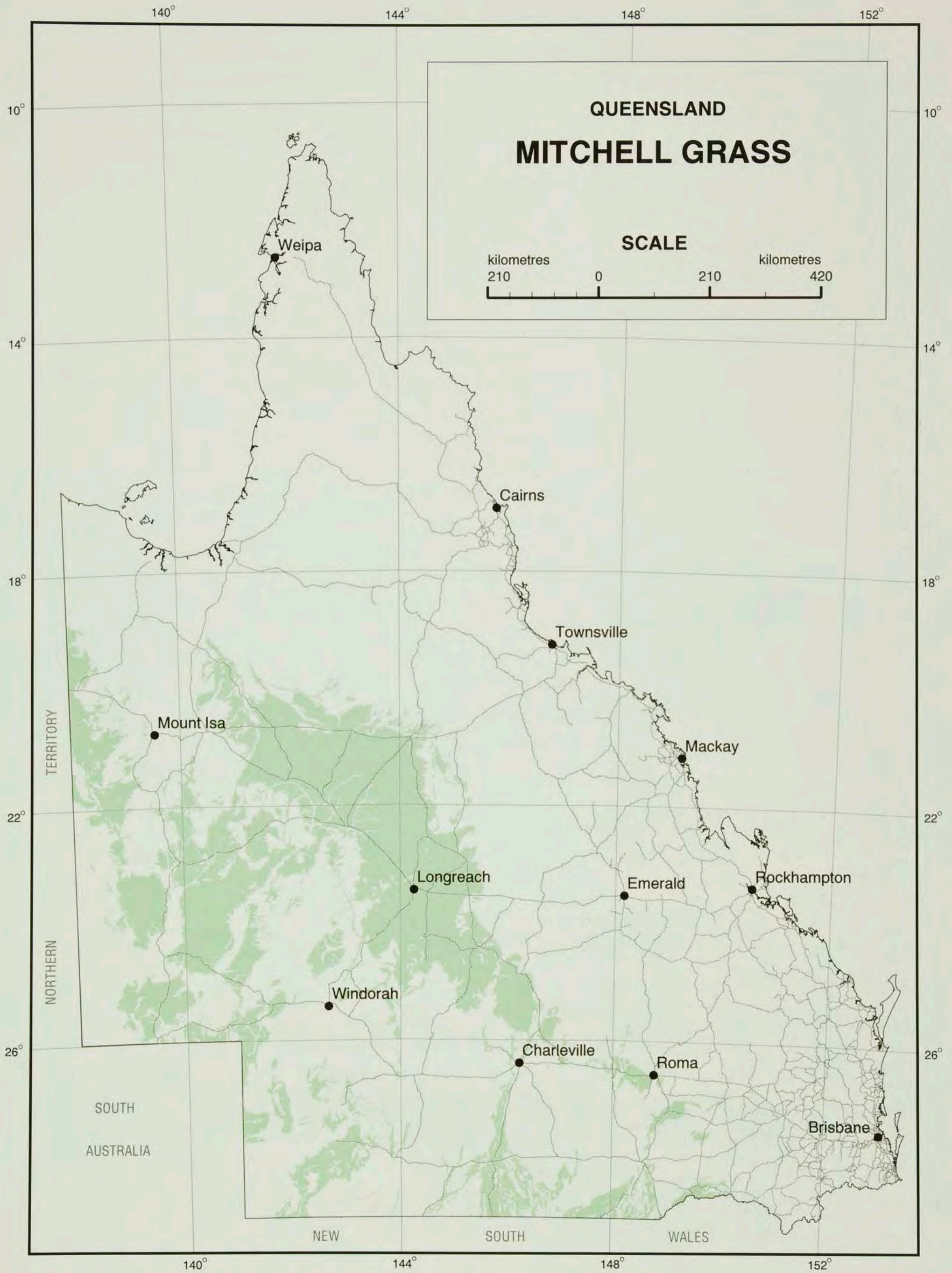
Mitchell grass is renowned for its resilience under heavy grazing and variable rainfall; it recovers well in good years due to its deep root system and tough tussock crowns.

In most seasons, moisture, not nutrients, limits grass growth. Despite this, mitchell grass is only reasonably nutritious and palatable, and stock prefer forbs (commonly called herbage) and other grasses during the growing season. However, it hays off as valuable standing feed for the long dry season.

[**Note.** Pasture scientists define **herbage** as all the non-woody plants in a pasture—both grasses and broad-leaved plants. The non-woody broad-leaved plants are referred to as **forbs**.]



*The vast rolling downs of western Queensland*



Map showing the area of the mitchell grasslands in Queensland



*Droughts are part of the normal cycle ...  
... but are often broken by flooding rains*



## Rainfall and droughts

Annual rainfall ranges from below 250 mm on the western edge of the region to about 550 mm. In the north, 85% of this falls from December to February, and since plants grow for only 4–6 weeks after rain, the growing season lasts for 10–12 weeks. The growing season lengthens towards the south where 35% of annual rain may fall in winter.

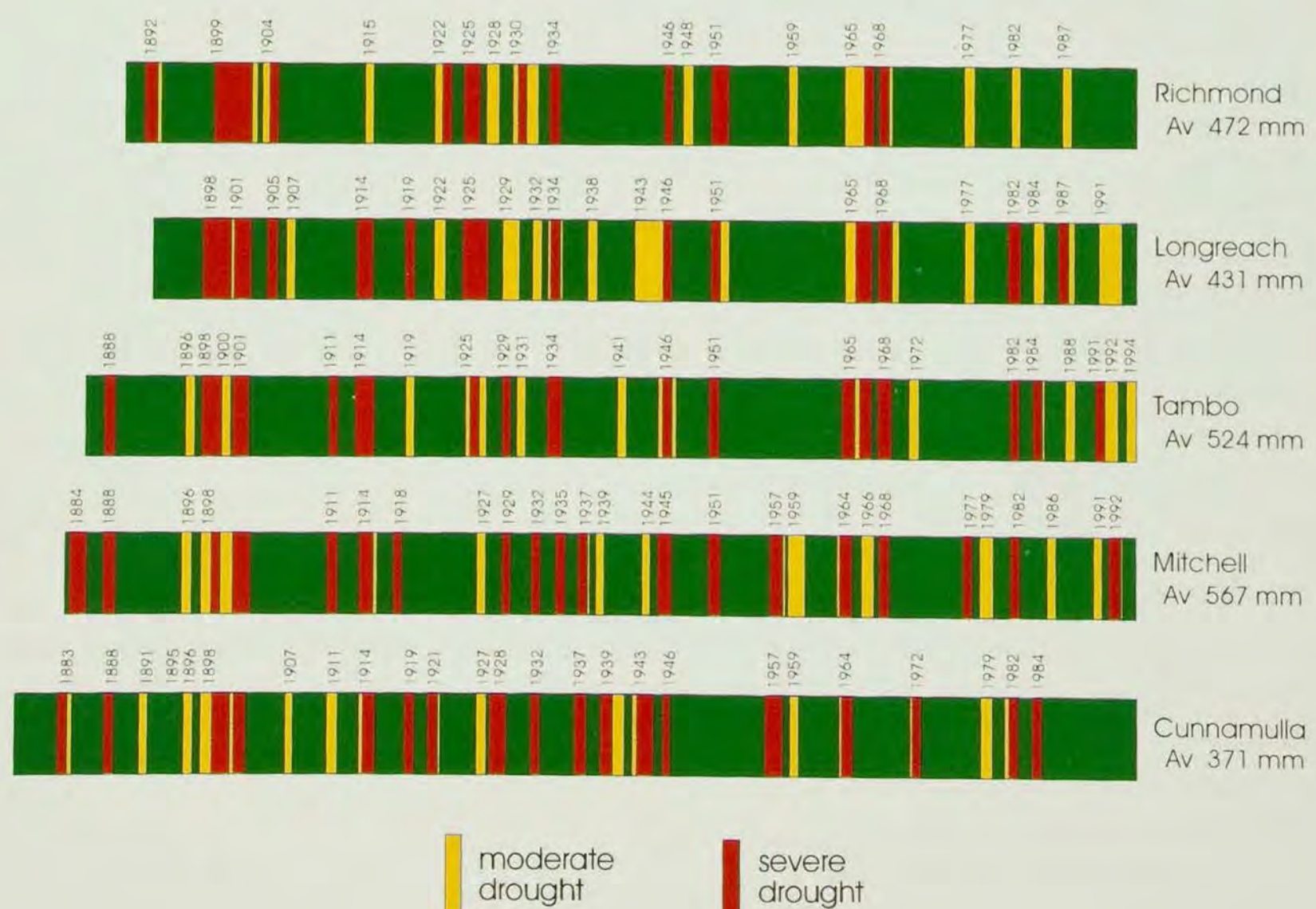
Rainfall is highly variable between years, with about four years in ten being considered good. The best years have a longer growing season rather than more rain.

Droughts are a normal part of the weather, occurring irregularly every 5–7 years. Most occur as a failure of the rains during one wet season, but major droughts develop after a sequence of dry years. These longer droughts are rarer, but have important consequences for stock and pastures.

Droughts are defined here as severe rainfall deficiencies over a minimum period of 12 months. A moderate drought has rainfall less than that received in the driest 10% of years, a severe drought less than that received in the driest 5% of years—at any location.

The occurrence of moderate and severe droughts for Julia Creek, Longreach, Blackall and Mitchell over the last century is shown below.

**While droughts do not come round at regular intervals, they will keep on occurring in the future, and must be planned for as a normal part of property management.**



## Northern, central and southern regions

Many aspects of grazing management for mitchell grass are similar throughout the zone, even though conditions and the associated species are very different between the Barkly Tableland in the tropical north and the subtropics of New South Wales.

The mitchell grass zone in Queensland is almost continuous but, for the purpose of this book, it can be split into three regions—north, central and southern—based on the seasonal distribution of rainfall.

### Northern region

The northern region of mostly treeless downs lies from the southern Gulf to about Winton. Rain falls only in summer producing summer grasses and summer forbs. The short growing season forces stock to eat mitchell grass for more of the year, and animal production is lower than in the south where the diet is more varied.

Under heavier grazing, annual grasses—flinders and button—become more prominent. Flinders grass provides good feed in summer and autumn, but its leaf and stem shatters quickly once the weather turns dry.

### Central region

The central region lies from Winton to just north of Blackall. The grassland has a covering of scattered trees, such as gidgee and coolibah, and is dominated by perennial herbage of mitchell grass and summer forbs such as malvastrum, native leek and *Psoralea*.

Occasional wet winters will produce winter forbs.

**The Blackall area.** The Blackall area is unique because buffel grass has been planted on the clay-loam soils once under gidgee shrubland. These soils are interspersed through the grassy downs.

### Southern region

The southern region lies from Augathella into northern New South Wales. The higher incidence of winter rainfall provides useful grazing from winter forbs, including medics, but also allows more stock to be carried. Under this grazing pressure, many mitchell grass pastures have been invaded by white speargrass.

### Climate variation

Long-term trends in rainfall have a major effect on pasture composition. A series of wet summers in a southern district will produce a northern-type pasture, with 90% grass. Similarly drought in the north followed by winter rain can produce a pasture composition more typical of the south.



*Mitchell grass in the north is often associated with large amounts of flinders grass when heavily grazed*



*The downs in the central region may have scattered trees especially along drainage lines*



*Mitchell grasslands in the south grow more winter forbs, but often contain white speargrass*



## Properties

Properties are largest in the north, averaging 25,000 hectares around Julia Creek, 15,000 hectares around Longreach, and 12,000 around Blackall. Most of these large properties have only 8–10 main paddocks, with a few smaller paddocks.

Properties under the better distributed rainfall of the south are smaller, ranging, for example, from 4,800 at Surat to 1,600 hectares around Hodgson.

## Property planning

Graziers have long been planning their properties. The DPI's *Property Management Planning* (PMP) program aims to help strengthen these business skills for all aspects (land, personal, financial and production) of the enterprise.



*Satellite images are useful for planning on large properties*

This planning builds on the individual's local knowledge and expertise, and involves:

- mapping the resources of land, water and infrastructure
- planning future management and improvements
- managing and monitoring areas of weeds, land degradation and conservation
- considering the financial costs and benefits of management options
- assessing whether these resources can achieve the plans.

## Land management types

Graziers recognise that their properties are made up of different types of land with differing soils and topography; these types are often based on the dominant vegetation. Some paddocks may contain a mixture of land types; if practical, land types needing greatly different management should be fenced separately.

### *North and central regions*

The main land management types are:

- alluvial flats and channel country along major rivers
- rolling downs with long slopes and shallow gullies
- wooded downs with scattered boree and gidgee
- gidgee woodlands (in the Blackall district).

**Alluvial flats** often contain gidgee and coolibah. They have the most fertile soils which are more sandy and come away faster after the first rains. As these flats are very susceptible to overgrazing, they should be



*Alluvial flats respond quickly to rain, but are susceptible to overgrazing*

destocked during the main wet season when there is plenty of grass elsewhere.

**Rolling downs.** The rolling downs are the main home for mitchell grass. Although mitchell grass plants are resilient and can survive for decades, excessive grazing pressure can result in loss of valuable species.

**Wooded downs with scattered boree and gidgee.**

The wooded downs are often the best country. The pasture is 'sweeter' and the shade puts less stress on the sheep, especially at lambing time.

**Gidgee woodland (of local importance).** Much of the gidgee country has been pulled and planted with buffel grass. Having more loamy soils, gidgee country responds more quickly to rain. It is often used for cattle fattening.

**Southern region**

Unlike the north, mitchell grasslands do not usually dominate the landscape; land types are more mixed with areas of mitchell grass, eucalypt woodland, cypress pine on dunes, brigalow-belah and mulga. On one property, open downs with mitchell grass clays may be bounded by open woodlands on shallow soils or by ridges associated with mountain coolabah, silver-leaved ironbark and yapunyah. The use of each land type is integrated in the overall property, although those properties that do have mitchell grass tend to have it as a major proportion of their land.

Large areas of mitchell grass have been ploughed out over the past 30–60 years, and the land used to grow winter cereals such as wheat for grain and oats for forage.

Wheat yields and protein levels have been declining after many years of continuous cropping, and a ley pasture phase using lucerne or medics may now be needed to restore soil fertility.

**Mitchell grasses—curly, hoop, bull and barley**

The most widespread of the mitchell grasses is curly mitchell (*Astrebla lappacea*) which covers vast plains throughout the zone. Hoop mitchell (*A. elymoides*) is also widespread, and is prominent in overgrazed areas in the south of the region. In the north, bull mitchell (*A. squarrosa*) is dominant on the poorly-drained plains south of the Gulf of Carpentaria, often being mixed with hoop mitchell; it is also prominent in wetter locations on the rolling downs. Barley mitchell grass (*A. pectinata*) occurs in the drier areas, on the Barkly Tableland, in the Kimberley region of Western Australia, and on less severely cracking clays. Mulga mitchell (*Thyridolepis mitchelliana*) is not related except in common name.



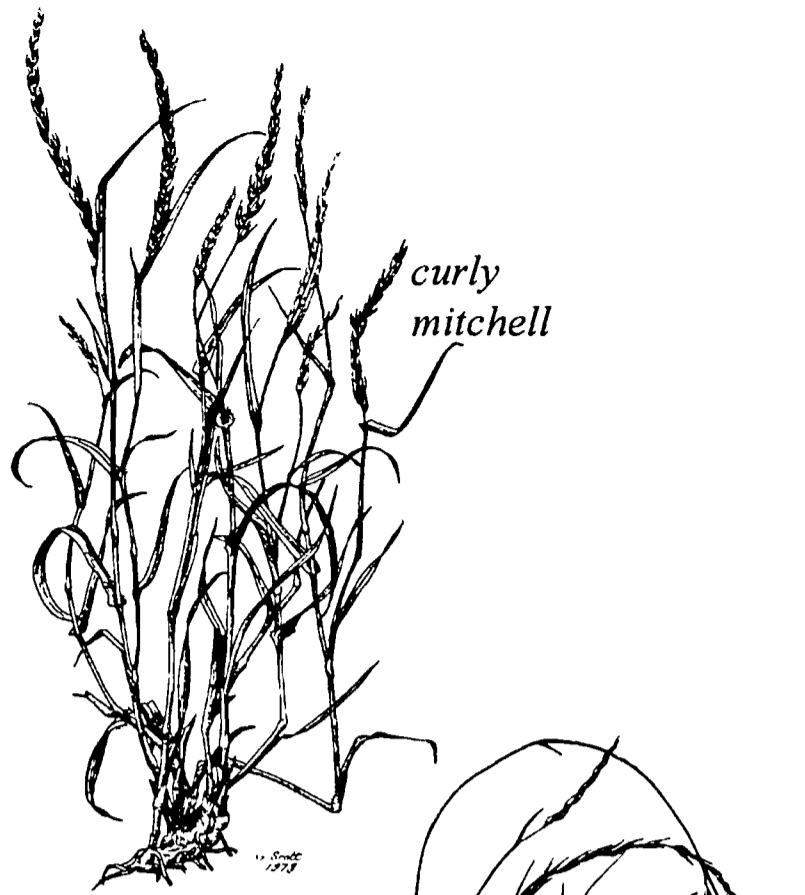
Rolling downs are the home of mitchell grass



Mitchell grasslands are more mixed with other land types in the south, and are often cropped

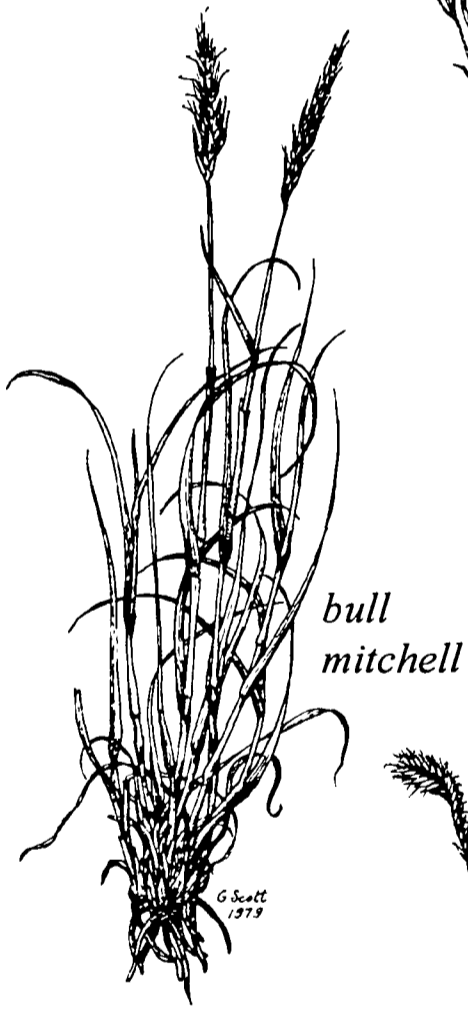


Seed heads of the mitchell grasses (left to right): bull, barley, curly, hoop



curly  
mitchell

hoop  
mitchell



bull  
mitchell



barley  
mitchell

**The mitchell grass sward.** The sward is composed of tussocks of one or more of the four species of mitchell grass. The size of the tussocks fluctuates with rainfall and with grazing pressure, but the total area of the clump bases seldom exceeds 5% of the land surface. During drought, the tussocks become grazed down and sparse, and may break up into smaller plants; after a series of above-average rainfall years, they thicken up to exclude other species.

**Associated species.** Other species associated with mitchell grass vary with the region, with past grazing pressure and recent rainfall. Rainfall in mid-summer tends to favour perennial and annual grasses, rain in spring and autumn favours wire grasses, weakly perennial plants and summer forbs, rain in winter produces a wide range of winter forbs.

In the north, gulf and desert bluegrasses and silky brown top are locally common while annual flinders grass and button grass increase under heavy grazing. Better distributed rainfall in the south produces a wide variety of both summer and winter forbs, and perennial grasses, especially the *Aristida* species—white speargrass and feathertop.

Queensland bluegrass and feathertop often increase after a series of good summers in the central west.

[See the back of this book for a list of scientific names of grasses and forbs, and for photographs of some important grasses.]

### How mitchell grass grows

New mitchell grass plants establish well after a run of good wet seasons. Major establishment events occur only infrequently in the north-west, and while seedlings may grow nearly every year in more favourable districts, most do not survive.

**Flowering.** Flowering is initiated by rainfall during warm weather. Seed matures after 4–6 weeks, but may not drop for another 3–4 months.

**Seed.** Mitchell grass can drop over 200 seeds per square metre after a good summer. These are usually dormant over winter, ready to germinate in the next summer—about 10% will carry over for a second year. Most of the seedlings die in false starts to the rainy season or from competition with rapidly growing annuals.

**First year seedling.** Seedlings are slow to develop, and normally need more than one growing period during the summer to develop secondary roots, and so to establish properly.

**Immature plant.** The immature mitchell grass plant develops towards a mature tussock under favourable

rainfall over the next three years, becoming increasingly able to stand heavier grazing.

**Mature plant.** A mature mitchell grass plant may live for 3 to 30 years. It produces new stems from basal tillers after good rainfall, but can grow new leaves and secondary tillers on old stems after moderate rain.

**Root system.** Mitchell grass has a dual root system. In curly and hoop mitchell grass, wiry roots growing outwards from under the crown occupy an area of about one square metre, and can tap moisture from small falls of rain. The roots then travel unbranched straight downwards for about 75 cm, through the zone where soil moisture fluctuates widely, before forming a network of branches. Rain water can penetrate to this depth through the deep cracks even if the soil profile is not fully wet.

The deep rootlets can extract moisture slowly and keep plant stems alive when it has hayed-off.

The horizontal roots and stem bases in a mature plant become thickened. These carbohydrate reserves help the plant to recover after winter or drought.

**Yield.** The average yield of mitchell grass pasture is about 1500 kg/ha of dry matter per year. This may range from a few hundred kilograms of high quality feed in a dry year to 4 tonnes of low quality forage in a good year.

## Changes under grazing

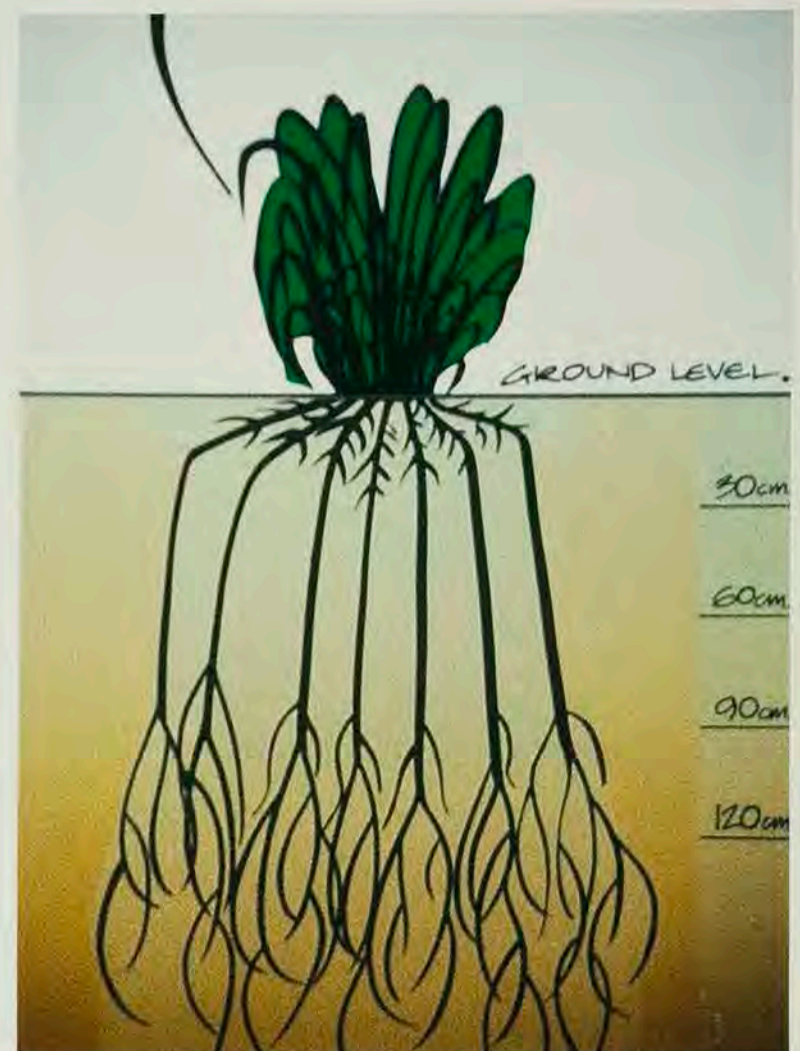
### *How tough is mitchell grass?*

Under conservative grazing practices, mitchell grass pastures are very resilient to drought and heavy grazing, and cannot be bettered for this environment.

Mitchell grass pastures are resilient because:

- mitchell grass is not very palatable and so can grow and set seed while other species are eaten preferentially
- the root system allows tussocks to persist through drought and under heavy grazing in the dry season
- the grass plants are very long-lived—up to 30 years
- the clay soils have good water-holding capacity and moderate fertility
- the plants help to stabilise the soil
- the gentle relief of the country reduces the risk of erosion.

Mitchell grass is normally grazed heavily during the dry season after it has completed its growing cycle, but recovers well with the next rains. However, it can be damaged by very heavy stocking over a long series of dry seasons, or around water points.



*Mitchell grass's dual root system: shallow for surface moisture, deep and vertical for survival in cracking clays*



*A typical year's growth of mitchell grass—1500 kg of dry matter per ha per year*



*Annual grasses and forbs are grazed before mitchell grass*





*Different grazing pressures on mitchell grass*



*Mitchell grass tussocks break up under heavy grazing and drought*



*Mitchell grass can be completely grazed out around yards and troughs*

### ***When is mitchell grass most susceptible?***

All grasses are most easily damaged when sprouting just after the first storms at the end of the winter or the dry season or after a drought—that *first green pick*.

There is little that a grazier can do to protect that green pick when storms are localised, paddocks large and kangaroos plentiful.

However, mitchell grass is usually not placed under pressure. If there has been enough rain to make mitchell grass grow, there will usually be plenty of annual grass seedlings and forbs which stock prefer to eat first.

### ***Which species are eaten first?***

The leaves of mitchell grass are high in silica, especially in the hairs along the edges and mid-rib, and are not particularly palatable.

Sheep eat forbs and annual grasses first, then bluegrasses, leaving most of the mitchell grass until late autumn. Then they eat seed heads first, then leaf, followed by the seed stems.

Cattle are less able to select plants close to the ground, and so turn to mitchell grass earlier than sheep.

***Sheep or cattle?*** Sheep bite off parts of a plant whereas cattle rip off their feed by wrapping their tongues around the leaves and pulling. Thus sheep can be more selective, eating the leaves of grasses and leaving the stem; however as they can eat closer to the ground, they can damage the grass crown during drought. Sheep tend to eat more browse, and will eat, for example, young soft roly-poly which cattle avoid.

Cattle will eat more stemmy herbage, and can be used to open up tall pastures so that more green leaf is available for sheep.

### ***What if mitchell grass is overgrazed?***

When overgrazed, mitchell grass behaves like most other grasses—it develops fewer leaves, fewer new tillers and produces less seed. Large tussocks, which can be up to 30 cm across, break up; the small tussocks may die if their diameter is reduced below 5 cm. This break-up also occurs during droughts.

The inter-spaces between small tussocks may fill with annual grasses. Under long-term severe overgrazing, flinders grass may also be grazed out, and be replaced with button grass or bare ground.

In degraded areas around troughs, mitchell grass can disappear completely, leaving only weeds such as potato bush, malvastrum and annual saltbush.

In droughts, when mitchell grass tussocks are the only vegetation remaining, sheep and roos dig up and eat the rhizomes while horses dig out the whole tussocks.

### ***And if it is undergrazed?***

Undergrazing is no good for mitchell grass either—moderate grazing stimulates tillering. Ungrazed plants become moribund as old leaf and roots accumulate and tie up the supply of available nitrogen in the soil; they may even die.

Weeds, such as soft roly-poly, may increase because they are not eaten by sheep while young and soft. The early explorers reported vast plains of roly-poly on the downs.

With the light grazing pressure often associated with wet years, feathertop increases causing serious problems with fleece contamination.

### ***What are the main weeds?***

The worst weeds in mitchell grass pastures are:

- woody weeds—prickly acacia, algaroba, parkinsonia and sometimes mimosa
- spears and burrs causing vegetable fault in wool — feathertop, white spear, bathurst burr and noogoora burr.

### ***What other problems can or could occur?***

Winter rainfall will encourage fungi which balcken feed, reducing the quality of the standing hay.

Periodic plagues—of rats, locusts, army worm—can devastate whole paddocks of grass.

Parthenium weed could invade some overgrazed mitchell grasslands under favourable rainfall.

In the mitchell grass areas of the Kimberleys, 'black soil blindness' has killed cattle.

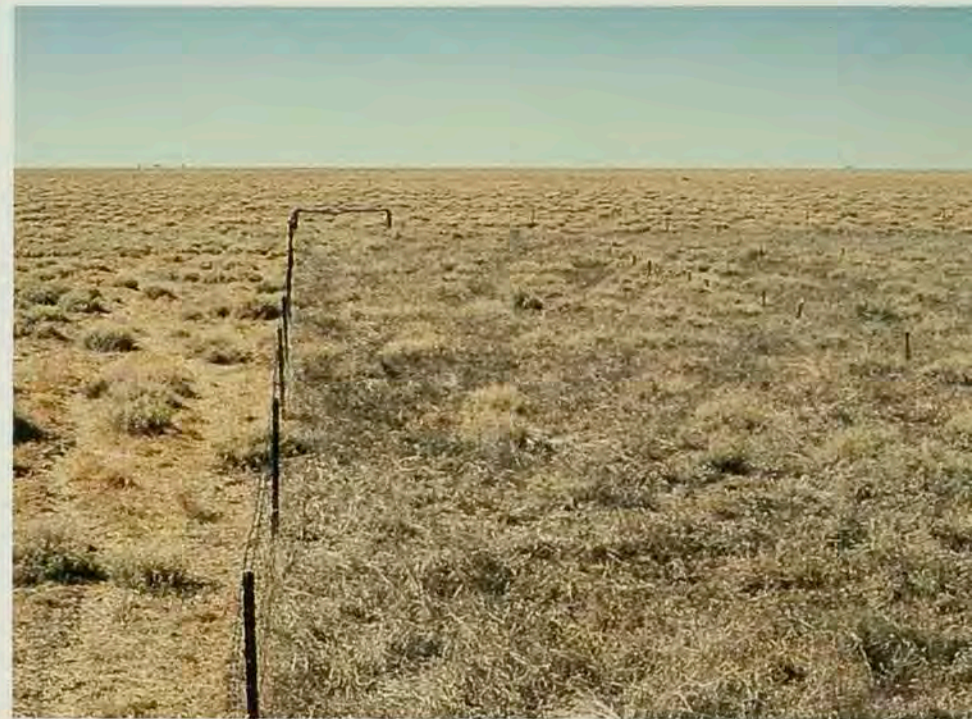
### ***What is 'black soil blindness'?***

Black soil blindness is a disease caused when cattle eat a fungus that grows on mitchell grass. So far it has been found only in the Kimberleys and maybe only with particular seasonal conditions.

The fungus produces a hard body on the stems of the grass at a node or axillary shoot. This looks like a ball of rough dry dough or coral 10–20 mm in diameter, but is highly palatable to cattle.

Up to 5% of stock grazing affected mitchell grass can die. The clinical symptoms are blindness and dehydration, with death within a day of the symptoms first being noticed. Post-mortem examination shows kidney and liver damage.

Even though quarantine may bar hay or stock from the affected districts, you should keep your eyes open if stock die quickly for no apparent reason or act blind in the yards.



*Undergrazed (grey) mitchell grass becomes moribund as nitrogen is tied up in organic matter*



*White speargrass and feathertop are problem grass weeds*



*This fungus on stems of mitchell grass has killed cattle in the Kimberleys*

# Management guidelines

Mitchell grass is productive and resilient. There are only a few options for managing the pasture, but these can have important consequences for its condition. Most property management has focused on physical development, fencing and water supplies.

The pasture management options are:

- setting stocking rates
- managing kangaroo grazing pressure
- moving stock and spelling
- burning
- controlling woody and other weeds
- improving the mitchell grass country.

## Setting stocking rates

Stocking rate (the number of hectares for each sheep or cattle beast) is the most important factor in grazing management; it has an over-riding effect on pasture stability and animal production.

Light to moderate stocking is sustainable, keeping the land and pasture in good condition, and allowing each animal to reach its potential productivity.

Stocking too heavily weakens the valuable species, encourages annual grasses and broad-leaved weeds, exposes the soil surface to erosion, limits each animal's production and increases the need for drought or dry season supplements.

Most of the deterioration seen in pasture land in northern Australia can be attributed to overgrazing.

Stocking rates can be set at a safe long-term (strategic) level or adjusted each year (tactical).

### **What is the right long-term stocking rate?**

Safe long-term stocking rates have been set from local experience. Groups of local graziers have estimated suitable sustainable stocking rates for each land type.

While most graziers agree on what would be desirable stocking rates, many actually graze at higher levels when under economic and social pressure.

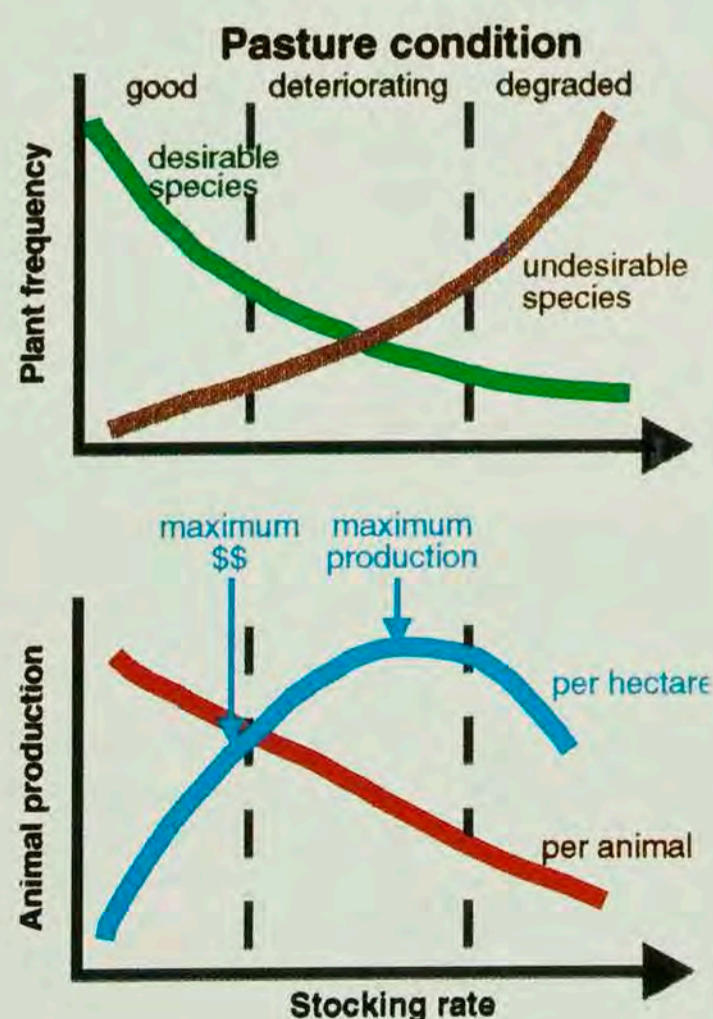
**Short-term profits are often higher with heavy stocking, but they cannot be maintained indefinitely without damaging the resource.**

### **Is this general stocking rate right for me?**

The producer-recommended long-term rates for different types of country are fairly broad. You can refine them with more local experience or by monitoring the pastures each year to see if they are improving or deteriorating.



*Stocking rate has the over-riding effect on pasture stability and animal production*



*The best sustainable economic returns are developed at stocking rates below those giving the maximum animal production per hectare*

## Locally recommended stocking rates for sheep and cattle

District	sheep - ha/dse	cattle - ha/ae
<i>northern</i>		
Julia Creek	1.6	10
Longreach	1.4	8
<i>central</i>		
Blackall	1.2	6
<i>southern</i>		
Hodgson	1.0	10
Muckadilla	0.8	8
Surat	1.2	7.5

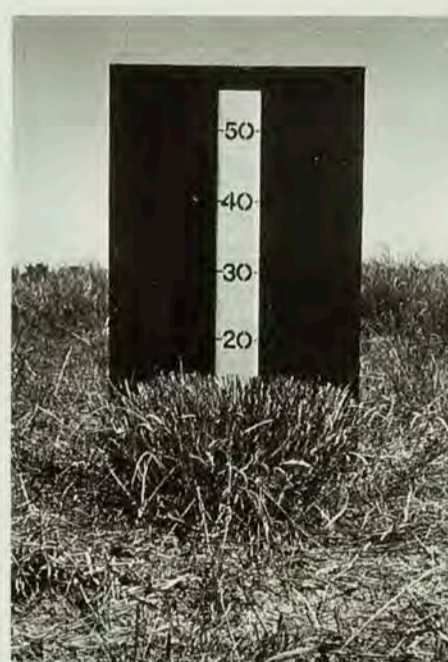
*Sustainable pasture utilisation—  
how much of the standing feed can be eaten  
without damaging the pasture*



*0% eaten—  
never make any  
money that way!*



*10% eaten—  
wasteful but OK  
for spelling after  
a long drought*



*30% eaten—  
about right for  
the long term*



*50% eaten—  
getting too heavy  
for every year*

### **Why monitor pastures?**

Monitoring is a fundamental part of managing native pastures for sustainable use. Persistent changes in pastures may take several years to show up, and it is difficult to remember exactly what each paddock was like five or ten years ago.

#### **Memories are short and selective.**

Variable rainfall will cause year-to-year fluctuations in species, but if the condition of your pasture is poor for three out of five years, you had better take notice when calculating stocking rates.

#### **How can I calculate a stocking rate for the next year?**

You can estimate how much feed is available at the end of summer to calculate a safe stocking rate for the next year, assuming that little rain may fall in the next summer. Thus the feed present at the end of this summer has to be enough to safely carry stock through this winter and the next summer.

Stock numbers should be adjusted to eat (utilise), over the next year, only 30% of the feed standing in March or April. Levels of utilisation of mitchell grass can be seen in the accompanying photographs—100% utilisation means removing all of the plant to ground level!

One dry sheep equivalent (dse) is estimated to eat 400 kg of dry matter a year. If there are 1300 kg/ha of dry matter in the paddock in March and you plan to use only 30%, there will be 400 kg of feed available—enough for one sheep per hectare. One adult equivalent (AE) of cattle is usually reckoned to be equal to 7 (in the north) or 8 (in the south) dse.

The decision support program GRAZEON can help you refine this by also taking into account:

- pasture condition
- species present, their palatability and value
- types and classes of stock
- kangaroo grazing pressure
- climate and pasture growth forecasts.

GRAZEON can help reduce risk from future drought.



*Long bore drains allow good distribution of grazing, but waste water*



*Water points must be well distributed when bores are capped*

While sheep and cattle are interchangeable, mixed grazing is complementary as they may eat different plants and different parts of the plant. Cattle will eat more fibrous material giving sheep access to better quality feed.

### ***How important is distribution of water points?***

In semi-arid areas, water is critical for management of stock and pasture. In summer, sheep will range only about 3 km, cattle 5 km, and they may have to return twice a day. Over the artesian basin, long open bore drains have allowed stock to graze over large areas; now as bores are being capped to prevent waste of water, the distribution of water points will affect how far stock have to walk to drink and thus the overall utilisation of a paddock.

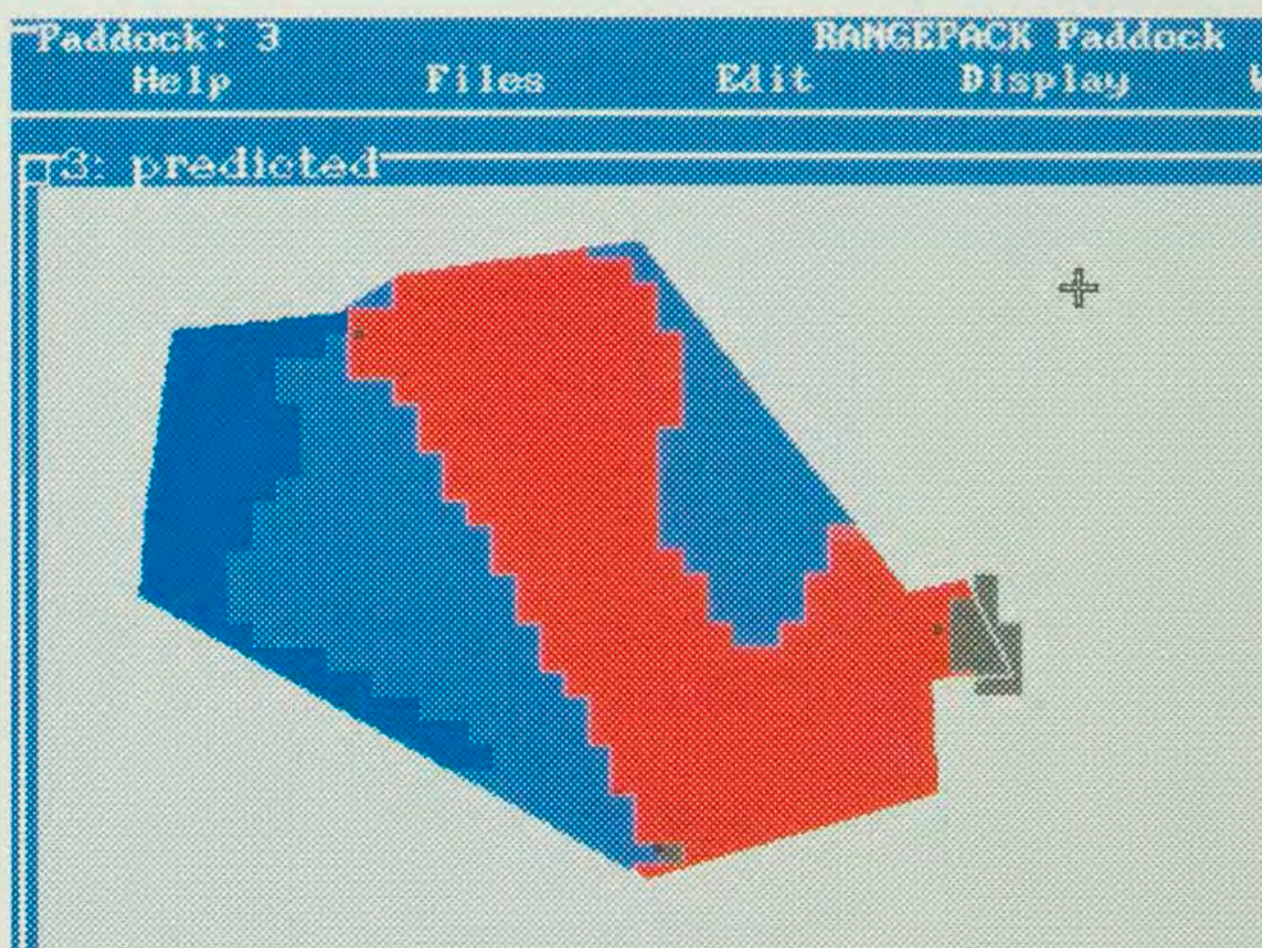
### ***Where should my watering points be placed?***

The distribution of the water points in a paddock in relation to fencing, prevailing wind direction and preferred pasture types will affect how the animals graze over the whole area.

The Paddock module of the decision support program HERDECON can allow you to enter these factors on a paddock plan, and to test re-arranging watering points to achieve more even grazing over the whole area.

**Your effective stocking rate has to take into account the distribution of watering points in large paddocks and the number of kangaroos you are carrying.**

*Computer models can suggest the optimum location of water points, depending on pasture types, prevailing winds and paddock shape*



## Managing kangaroo grazing pressure

Managing total grazing pressure is an important part of the strategy for Queensland's semi-arid grasslands; kangaroos are a particular issue because we have 14 million of the estimated 27 million kangaroos in Australia.

Kangaroo numbers in the mitchell grasslands increased greatly when water supplies were improved and the dingo population controlled, and they are now as abundant as sheep in some areas. Roos generally compete with sheep for forage, contributing significantly to the overall grazing pressure; while sheep and cattle can be controlled by fencing, kangaroos are free-ranging and graze wherever water and grass is available.

Kangaroos are often given as a major reason why graziers do not introduce systems of better grazing management. For example, grasses should not be grazed heavily after a fire, yet when you attempt to spell such an area, your efforts can be negated by the invasion of large numbers of kangaroos.

### ***How much feed do kangaroos eat?***

Three kangaroos eat as much as two sheep, generally from similar types of pasture. The kangaroo population has to be controlled where the numbers are excessive.

### ***How can I control the kangaroo problem?***

**Shooting.** Shooting can turn a problem into a profit. Professional shooters are in business to make money from meat and hides, but have to operate on a quota. They prefer the large males, whose demise has negligible effect on the population. Once the local population does drop, shooters move to more bountiful hunting grounds.

### **Shooting for effective control may mean employing shooters specifically for that task.**

Shooting is easiest and may have most impact on a local roo population when their numbers are low during a drought; but by then the pasture has been damaged while the hides and carcasses are in poor condition and worth little.

The best method is to concentrate harvesting going into dry times—the animals are in good condition, standing pasture is conserved, and a slow death by starvation is avoided.

Shooting can be effective in open mitchell grass areas, but is rarely so in timbered country where vehicle access and visibility are poor.



*Roos can be a major problem for good pasture management on the downs*



*Shooting is still the most effective way to control excessive numbers of roos*



*Turning a problem into a profit. However, culling to reduce the roo population is most effective at critical times*

The Finlayson trough is not recommended by the DPI  
The Finlayson trough is not recommended by the DPI



*The 'Finlayson trough' uses an electric fence wire at a critical height and distance from the trough ...*

*... sheep step over the wire, roos touch it with their tails when drinking*



**Finlayson trough.** The Finlayson trough uses an electric fencing wire strung 7 cm high and 1 metre away from the water supply. Sheep will walk over the hot wire, whereas the roos' tails touch it. For a cooler drink, the roos move next door.

However after a time, the roos learn to avoid the wire by sitting sideways or in the trough, while sheep which get zapped when walking backwards from the trough develop psychosis!

The Finlayson fence may be best used to restrict water for a short time to concentrate the kangaroos at other watering points before shooting to reduce the population.

**Turn off the water.** Capped bores or troughs can be turned off to spell a paddock if there is no other source of water. This should be combined with a shooting program to alleviate suffering by the thirsty kangaroos.

**Fence off reticulated waters.** A roo-proof fence with swing or trap gates for cattle or sheep around your water point may persuade roos to drink elsewhere. Trapping roos is illegal.

There is no cheap (and legal) method of effective control. Some methods, such as restricting access to water supply, merely push the problem towards a neighbour unless a harvesting program is initiated at the same time.

**Controlling kangaroo numbers does not mean their annihilation.**



## Moving stock and spelling

Stock can be moved between paddocks under various grazing systems, or moved out off the property for agistment or sale.

**The total number of animals on the pasture is generally much more important than how they are moved around.**

### *What grazing systems might be useful?*

Stock can be grazed continuously or rotated between paddocks. A paddock can be rested or spelled at times in 'deferred' grazing.

Some form of rotational grazing is often used, but generally for animal rather than pasture management. While any form of strict rotational grazing has little relevance on extensive properties in semi-arid rangeland, spelling can be beneficial on heavily grazed paddocks, provided kangaroos are taken into account.

### *What is the best system for mitchell grass?*

Mitchell grass will last indefinitely under continuous grazing with the number of stock adjusted each year to the feed available, and with opportunistic spelling.

Some properties keep sheep numbers constant at a level that can be handled with the labour available, and buy cattle when feed is plentiful and sell when it is short.

### *Can grazing reduce feathertop or white spear?*

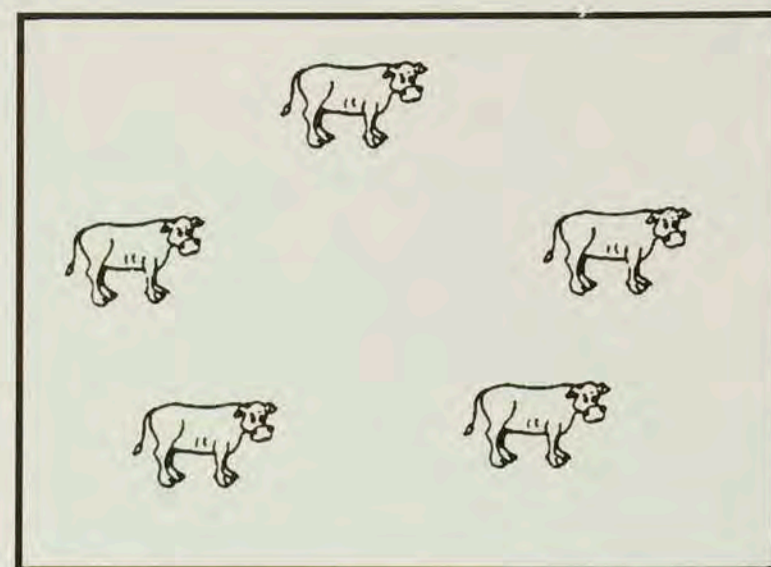
Feathertop is a fairly leafy plant with a weak crown. As neither it nor white speargrass can stand defoliation, crash grazing with large numbers of sheep for 1–2 months at the start of the growing season might control them. Cutting and baling the herbage has had the same effect. Stock will eat feathertop hay.

Paddocks which are treated this way should be monitored to make sure that the mitchell grass is not being damaged.

### *Is continuous grazing the same as set stocking?*

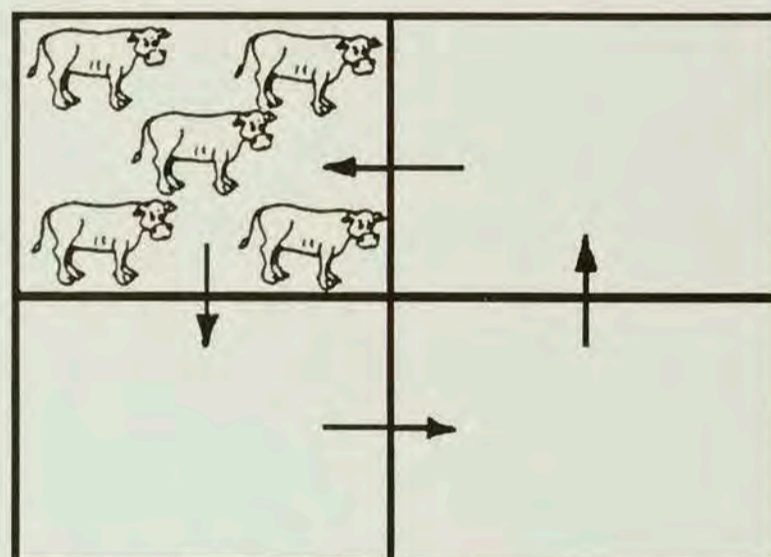
No! Continuous grazing just means that animals are not moved between paddocks; however, the number of stock should still be adjusted to the feed available.

With the large variation in summer rainfall, set stocking with the same number of animals every year would mean eating 60–80% of the feed in dry years and only 10% in the wettest years.



*Continuous grazing*

**Continuous grazing with stock numbers adjusted to the feed available and occasional spelling is a good system for mitchell grass**



*Rotational grazing*



*Many graziers keep a nucleus flock, and buy and sell cattle according to the feed available*



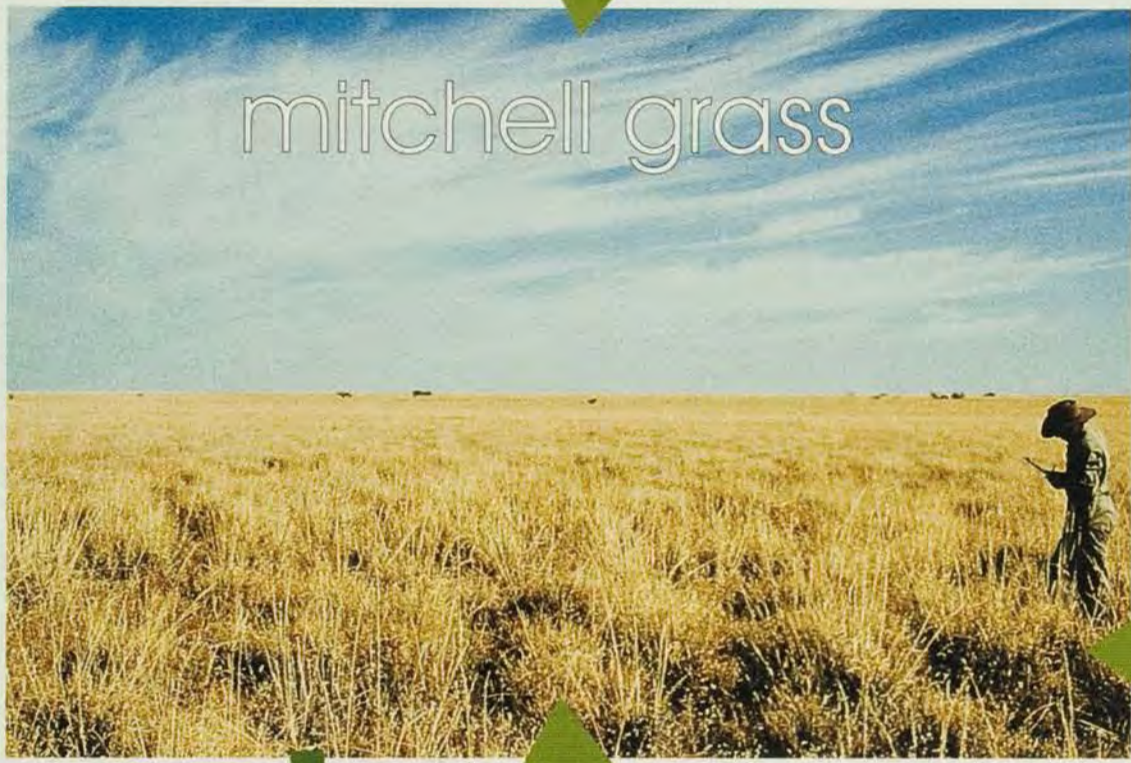
heavy grazing after droughts, floods, fire

good rainfall, lighter stocking

mitchell, fl...



mitchell grass



woody weed seed, cattle

woody weed seedlings



mechanical or chemical control, sheep

Northern and central regions  
Southern region

cattle, spring burn, crop and reseed

overstocking, floods

mitchell, w...  
and feathe...

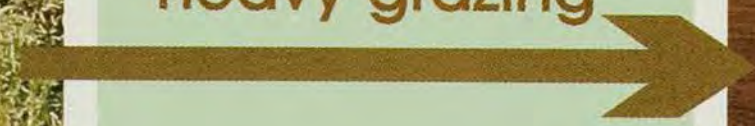


Good

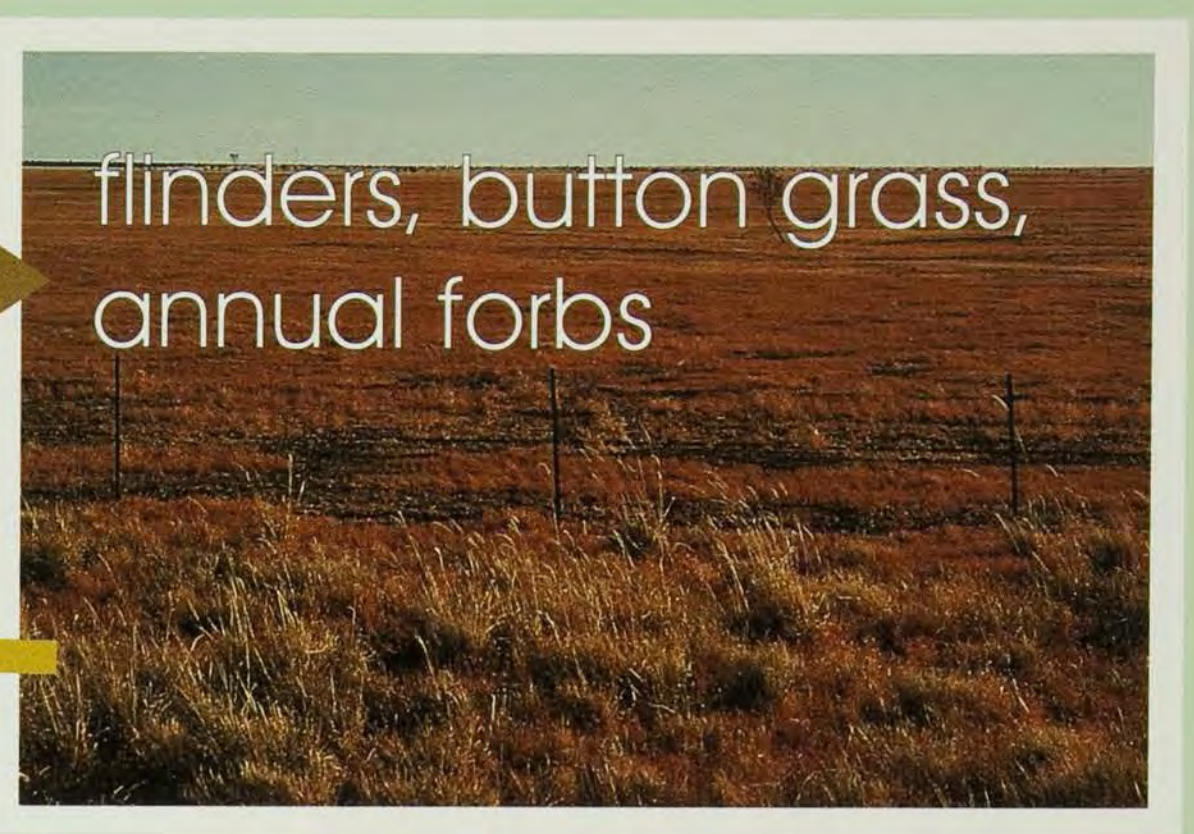
Go...



continued heavy grazing



good rainfall lighter stocking, mitchell seed



no control



mechanical and chemical control, mitchell seed



The state of your pasture depends on past seasons and on your management



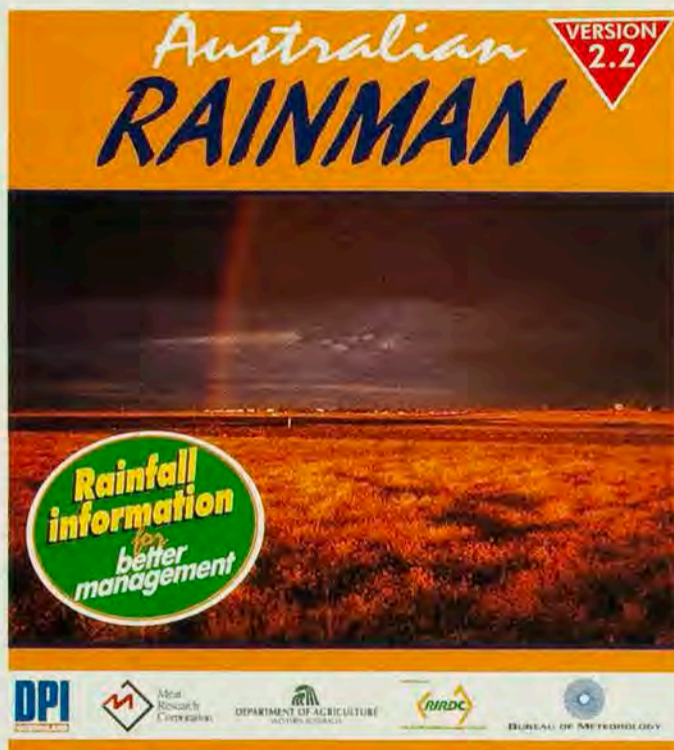
Clay pans



Gone



*Adjust stock numbers before the pasture is damaged*



*Rainfall information for your locality*



*Move stock before the mitchell grass tussocks reduce in size*

### **What's opportunistic spelling?**

This means that you do not increase stock numbers greatly to eat all the feed available in a good year. Instead you allow the grass to recover from the bad years, to build up its reserves and to drop plenty of seed.

In a good year, there is feed everywhere and the roos will not concentrate on your spelled paddock, whereas spelling during an average year just invites the kangaroos to dinner.

In the south, mitchell grass is sometimes spelled when sheep are moved to forage crops to avoid contamination of the wool by seeds of white speargrass.

### **When do I adjust stocking rates?**

Stock numbers should be adjusted at the end of the growing season in April–June after checking the amount of feed in the paddock. Stock should be in good saleable condition at this time.

Stock adjustments may have to be made at normal mustering times around this time. For sheep, this could be at marking, weaning, crutching or shearing; there is a wide variation in sheep operation times within districts and between regions. Cattle numbers can be adjusted at weaning in April or May.

### **'God's will' or can we forecast droughts?**

Until recently, the causes of droughts were not understood and we accepted them as random events. Now with a better understanding of our weather systems, we can get a forecast of the seasons ahead using the Southern Oscillation Index or Sea Surface Temperatures in the Pacific and Indian Ocean.

The DPI computer package – AUSTRALIAN RAINMAN – can use the present values of the SOI to calculate the probabilities of rainfall in your district months ahead.

### **What's the SOI this month?**

Monthly SOI values are given on the weather page of the Queensland Country Life and on the ABC Weather Forecast on Wednesday evenings.

You can check the latest values for the SOI by phoning the DPI Hotline on (07) 877 9602 or the Fax Hotline on (019) 725 301.

**Accurate short-term seasonal forecasting holds the key to more efficient and safe use of our grazing lands.**

Chances of getting average rainfall from October to December based on the SOI in May–June (from AUSTRALIAN RAINMAN)

Location	Av. rain Oct–Dec (mm)	Probability of getting average rainfall in Oct–Dec when SOI in May–June is:	
		below -5	above +5
Richmond	114	30%	60%
Longreach	103	35%	63%
Roma	175	27%	60%

### ***It's looking dry, when should I move stock?***

If you have not sold off stock in autumn, you should definitely move them before the tussocks of mitchell grass are chewed down below 10–15 cm high.

### ***What if I get winter rain?***

Winter rain can be a bonus or a curse. Good winter rain in the south and central region will produce top quality herbage.

Days of light rain or drizzle will 'blacken' the standing hay with mould, markedly reducing its quality.

Even in the south, the bulk of pasture growth occurs in the summer.

### ***What should I sell first in a drought?***

A severe extended drought is going to call for almost complete destocking, but stock numbers should be reduced as or before conditions worsen. Which stock are moved first will depend on the vulnerability of different classes of animals and the market.

Sales and segregation of susceptible stock, for example of cows due to calve in the mid to late dry season, allows for more efficient supplementation and reduced losses.

**Sell! Sell and regret maybe, but sell!**

### ***How can I increase flexibility against drought?***

Flexibility is best increased by stocking conservatively, while mixing sheep and cattle improves flexibility in marketing and pasture management.

Feeding supplements to stock and early weaning cattle will prevent animals losing too much condition.

Surplus flinders and mitchell grass can be cut for hay as a drought feeding reserve.

### ***How good is native pasture hay?***

Flinders and mitchell grass is routinely made into reasonable quality hay for weaners and for stock in yards or hospital paddocks. Feeding stock in the yards during handling and before transport will reduce unnecessary loss of condition.



*Good winter rain produces quality herbage, light rain lowers quality of standing hay*



*Get rid of stock before their condition drops*



*Hay can be brought in to feed stock, but local native pasture hay can save on transport costs*



*The feed value of baled native pasture hay can be improved by injecting urea, sulphate of ammonia and molasses*

There is never enough hay baled to feed all stock on larger properties during a drought.

Flinders hay is more common in the north, whereas mitchell grass hay is more common in central and southern regions. Flinders hay is easier to make as the land is often more even; mitchell grass tussocks and rough cracking clays are hard on machinery.

The grass should be baled when the leaf and stem are green, but just before the seed head forms. Hay of this quality is good enough to maintain most classes of stock.

Poor quality hay can be improved by injecting the bales with a mixture of urea, sulphate of ammonia and molasses in water.

Baling will also reduce the amount of feathertop and white speargrass in the pasture.

### ***When do sheep need supplements?***

A supplement of protein or non-protein nitrogen can be fed to sheep, especially pregnant or lactating ewes, and to cattle when there is plenty of poor quality dry feed available.

A supplement of true protein, as cotton seed, will improve production and lamb survival; non-protein nitrogen, as urea with salt or molasses, is much cheaper, but will only maintain an animal's condition.

Having to feed a lot of protein supplement every year even when there is little grass may mean that you are trying to keep too many stock over winter. The pasture may not be able to recover fully from poor years and will deteriorate.

Drought feeding has to be provided to keep sheep alive when there is no standing feed in the paddock. The need for this is reduced if you have planned ahead by adjusting stock numbers in the previous autumn.

In the south, 'drought lotting' (drought feeding a total ration in a fenced-off area) may sacrifice a small area of grazing but can take the pressure off the main pasture paddocks.



*'Drought lotting' can take the pressure off the main pasture paddocks and simplify supervision of weak stock*

# Burning

Mitchell grass is not generally burned because the feed is too valuable, the seasons are unreliable, and the benefits have been considered few. The largely treeless mitchell grasslands are thus different to most other native grass communities which need regular fire to control woody weeds and regrowth.

However, occasional fires may be useful for ecological management and stability.

**Fire is not used in normal grazing management for mitchell grass now, but it was once part of the natural ecosystem.**

## *What is the possible role of fire?*

Fire may prevent gidgee encroaching into marginal mitchell grass areas, and control gidgee regrowth after clearing land.

A spring burn, followed by spelling or light stocking, will decrease seed production of feathertop, kill about 20% of adult feathertop plants, and increase the proportion of mitchell grass.

Fire can remove old blackened grass leaf and so improve feed quality.

Run-away fires can be difficult to control where there are few natural fire breaks. Losing a little grass in a fire break may save a disaster later.

## *Will fire control prickly acacia?*

A hot fire will kill seedlings and saplings of prickly acacia under 1 metre high; it will do little damage to established plants as these will sucker from the base.

There is never enough grass under dense stands of prickly acacia for a good fire.

## *When can I restock after a fire?*

Fresh green grass after a fire will attract domestic stock and kangaroos. However, mitchell grass should be rested until it is at least 15–20 cm high, and ideally until the plants are fully grown again. This allows the mitchell grass plants to build up carbohydrate reserves and to produce new buds in the crowns.

While stock can be locked out of the paddock, kangaroos ignore fencing and are difficult to manage. If excessive numbers of kangaroos are likely to have a significant long-term impact on a burnt paddock, their population may have to be reduced by shooting.



*Even dry mitchell grass is normally too valuable to burn*



*Fires can remove accumulated old blackened herbage, and may be useful against feathertop*



*There is never enough grass under dense prickly acacia to carry a fire*



*A useful shade tree ...  
... that can become an ecological disaster*



## Controlling weeds

Woody weed invasion is the major problem facing the northern mitchell grasslands, with the most threatening species being prickly acacia. Other woody weeds are algaroba (mesquite), parkinsonia and mimosa.

In the southern region, the main woody weeds are native eucalypts invading from adjacent woodlands.

There are other important weeds—native and introduced—that may indicate previous management or a type of country. These weeds can:

- cause vegetable fault in wool — feathertop, white speargrass and various burrs.
- poison stock — Georgina gidgee and pimelea (which actually grow on adjacent land types).

## Prickly acacia

### *How useful was prickly acacia?*

Many years ago, some graziers in the north planted what appeared to be a useful shade and fodder tree, and for decades there appeared to be little problem and significant benefit. Shade increased lamb survival, while seed, pods and leaf fall provided extra protein.

## ‘Acacia arabica as a fodder’

... the tree will be of great value in the Western country where sheep are depastured, as, should it do well there, it will provide a grateful shade for sheep and afford a useful forage in the pods which are shed in late October, November, and December, when pasturage is usually in poorest supply.

‘There is, however, a drawback to this tree in cattle country, in that where cattle consume the pods, the seeds are not masticated and pass whole through the digestive tract, thus causing numbers of young trees to appear where they are not wanted. The expense thereby entailed has caused the Bowen Local Authorities to regard the tree with little favour. Sheep and goats, however, masticate the seeds, and so the danger of too great a spread need not be anticipated in sheep country.’

*Queensland Agricultural Journal 1 April 1926*



*Even small prickly acacia bushes reduce grass growth by competing for water*

However, after cattle started to replace sheep in the 1970s, the prophesied ‘numbers of young trees’ did ‘appear where they are not wanted’.

## Prickly acacia is now a serious weed problem in north Queensland.

As the population of shrubs rises and the canopy closes, the trees use the soil moisture, preventing grass growth. Grass production falls by 1000 kg/ha in return for only 75 kg of leaf and pod per year.

### *What is the problem?*

The problem has been recognising the weed potential of a few scattered trees before it is too late. Individual

Note: the scientific name changed from *Acacia arabica* to *A. nilotica* in the 1940s.

trees are not particularly difficult to kill with herbicide—even if it is a prickly job.

It is the scale of the operation with extensive infestations on low-value land that makes for economic problems. One mature tree can drop 175,000 seeds in a year and, although most germinate within a couple of years, some can remain in the soil for up to 10 years, ready to go in a wet year.

### ***How do I control prickly acacia on the property?***

Weed control always needs an integrated plan to prevent wasted or ineffectual effort.

The Land Protection Board recommends a property management plan to:

- map the prickly acacia areas
- determine the priority areas, the methods of control and the costs
- make a calendar or timetable to allocate your labour.

The plan of action is to:

- eliminate the seed-producing trees along bore drains, dams, creeks and drainage lines. Consider replacing open bore drains with piped water
- clean up the least infested paddocks
- keep cattle out of infested areas after late October when the pods are mature
- run sheep (and goats) rather than cattle in lightly infested paddocks
- quarantine stock moving from infested paddocks to clean areas for 7–10 days.

### ***Where do I start control?***

Start by controlling the plants that set the most seed—those along the bore drains—then move to the lightly infested paddocks to prevent further spread of seed. Last come the dense infestations which are the most expensive to control.

In light infestations, much time is spent moving from bush to bush. A 4-wheel motor bike fitted with a saddle tank and pressure pump speeds up the job, and has been known to make the job of spraying more attractive to teenagers!

### ***How do I control prickly acacia in the paddock?***

Big trees can be treated chemically or grubbed out mechanically.

Methods of chemical control of prickly acacia are described in the Lands Department's PESTFACT on Prickly Acacia and in WOODY WEED ADVISER, a DPI software program. These include:

- putting diuron in bore drains
- spray foliage with Starane in water along densely infested creeks



*One mature prickly acacia tree can drop 175,000 seeds in a year*



*First clean up the seed-producing trees along bore drains ...*

*... then the lightly infested paddocks*







*Spray bore drains with diuron*

- basal bark or cut stump spraying with Starane, Garlon 600 or Access in diesel
- spot treatment onto soil with undiluted Velpar
- applying Gridballs of Velpar or pellets of Graslan onto soil.

Because Graslan is absorbed onto clay particles, application rates have to be as high as 10—20 kg/ha on the clay soils of the mitchell grasslands, making broad-area treatment very expensive.

All these herbicides can be applied while stock are in the paddock, but some will also kill adjacent trees that you wanted to keep.

### ***How do I control prickly acacia in bore drains?***

Bore drains can be treated economically with the residual herbicide diuron.

Block off the water at least 24 hours before spraying diuron suspension (90% wettable powder at 33.5 kg/ha) in a 1 m wide strip onto the mud in the drain. Since a 1 m strip along 1 km of drain equals 0.1 ha, use 4 kg of wettable powder in 100 L of water per 1 km of drain. Wait 2—3 days before opening the drain again.

### ***What are the mechanical methods of control?***

Scattered trees can be killed using a specially designed grubber blade fitted to a front-end loader on a wheeled tractor. This blade cuts the tap root of the prickly acacia about 30 cm below ground level. The leaves of cut and pushed trees can provide protein feed until they drop.

Using the normal brigalow blade plough behind a D8 is usually too expensive (at around \$110 per ha) for the potential of this land; it also may damage the deep vertical root system of mitchell grass plants.

Chaining the deep-rooted prickly acacia is difficult and about three times as expensive as chaining gidgee. The swath width has to be reduced to about two-thirds, and it has to be pulled from both directions.

### ***What can I do with a densely infested area?***

This will depend on how much money you are willing to spend. You could just fence it off to prevent stock spreading the seed, or you could try to bring it back into production by chaining or aerial spraying. Chaining gives only temporary relief, but can be useful if there is some mitchell grass to recover. Otherwise you will have to try to sow mitchell grass seed into the bare ground.



*Grubber blade mounted on front-end loader*



*The grubber blade is especially useful for scattered prickly acacia bushes*

### ***Once and for all time?***

Unfortunately, no. There can be 24 million acacia seeds along every kilometre of bore drain. Although the half-life of this seed is about 18 months, some can remain viable for the next decade, and then germinate in a wet year to produce an overwhelming mass of new seedlings. Sheep will eat some young seedlings, but prefer the abundant herbage available in a wet year.

Diuron may have to be re-applied 3 to 4 times over a 10-year period or until the seed bank is depleted.

You could carry out periodic follow-up spraying before any new plants are big enough to flower (about 2 metres high) and produce seed.

### ***Is there any biological control?***

Prickly acacia is attacked by some native insects which may weaken stressed plants. The most effective introduced agent is a seed-feeding beetle, but seed loads are too high for it to have much effect.

The next closest thing to biological control at the moment is using sheep or goats to eat and digest the seeds of prickly acacia, and to eat young germinating seedlings.

Sheep and goats may eat the leaves and strip the bark off larger bushes, but rarely kill them. Cattle and camels have smashed down larger bushes to eat the leaves, but again without any permanent control.

**Don't wait for a miracle cure. Start your own control now.**

### ***How do sheep and goats affect prickly acacia?***

Sheep and goats eat the seed pods. Sheep may spit out about 15% of the seeds (goats 25%), but spoil the germination of all but 1% of those digested. Cattle pass about 40% of seed undigested.

Sheep and goats will also eat young seedlings, although they prefer grass; and grass is usually plentiful in the wet years that cause mass germination of prickly acacia seeds. Forcing sheep and goats to eat enough seedlings means stocking so heavily that some mitchell grass would be damaged also.

There is generally little or no mitchell grass under dense acacia, and uninfested adjacent areas of good grass may have to be fenced off.

### ***How can goats help in managing the problem?***

Goats will browse and weaken prickly acacia plants as high as they can reach—their browse line is about 2 metres.



*Sheep and goats eat prickly acacia seed pods, seedlings, leaves and bark*



*Goats like to browse, and so do more damage than sheep or cattle*



*Prickly acacia seeds pass undigested and viable through cattle*



*Note the seed pods of algaroba*



*Algaroba could become a bigger disaster than prickly acacia*



*Parkinsonia is another problem woody weed*

The best strategy for goats is to use them after a failed wet season (or preferably two) because:

- the large trees have produced no seed
- there is less viable seed and fewer germinating seedlings
- the trees are under stress.

Note however that this is also the time when the mitchell grass is most susceptible to permanent damage. The trees should be pushed or double pulled in August–September to make them more accessible.

Allow the goats at least three months to browse any remaining or re-suckering foliage, then replant grass seed in October–November.

### ***How much of a problem is algaroba?***

At present algaroba (mesquite) exists mostly as scattered stands or trees—the same as prickly acacia thirty years ago.

### **Algaroba has the potential to be a worse problem than prickly acacia.**

This is because algaroba is not eaten by stock, and is more difficult to kill than acacia—one hybrid type is resistant to most herbicides. It has low hanging branches which make basal bark spraying difficult.

Ranchers in Texas spend millions of dollars every year trying to control mesquite. Learn from their mistakes. Don't forget —

**by the time you recognise you have a serious algaroba problem, it's too late.**

### ***How can I kill parkinsonia and mimosa?***

Mimosa and parkinsonia can be spot-treated with Velpar. Parkinsonia can also be given a foliar spray of Grazon DS or Starane in water, or a basal bark spray of Garlon in diesel oil; however, these treatments are effective only when growing conditions are good.

### **Other weeds**

Other weeds that can cause serious problems include:

***Feathertop and white speargrass.*** Feathertop is wide-spread throughout the mitchell grasslands; white speargrass is more of a problem south of Tambo and east to Roma in the higher rainfall south-east.

Feathertop is more common in the central and northern areas under light grazing with sheep, declining under heavier grazing and with more cattle. It increases in wet years, which are associated with light grazing pressure, but declines in dry years. As feather-top is not strongly rooted and has a leafy crown, cattle can rip out the whole plant.

Potential strategies for control include buying in more cattle in the wet years, crash grazing at the start of the growing season, burning in spring, spraying and baling pastures for hay.

White speargrass in the south is encouraged by overstocking, especially with sheep. White spear is more stemmy and unpalatable than feathertop, and so is more difficult to eradicate through grazing management. Heavily infested grasslands can be ploughed out for cropping and subsequent pasture establishment.

Mitchell grass can be strengthened when spelled in autumn as sheep are moved onto forage crops to avoid speargrass seed contamination of the wool.

White spear can set massive amounts of seed in a wet autumn, but the seeds are fairly short-lived. Seeds germinate best in spring and autumn, with seedlings frequently suffering from 'damping-off' in wet summers.

Recommended long-term stocking rates, based on 30% utilisation of standing feed at the end of the growing season, may offer the best compromise between control of feathertop and white speargrass and good stability of mitchell grass.

**Burrs.** Bathurst burr often becomes dominant in heavily overgrazed and disturbed areas around water-points and gate ways; Noogoora burr can become a problem on flooded alluvial country.

Both burrs can be removed from strategic areas by spraying with herbicide or even hand-chipping; early action can save a lot of heart-ache later. The Noogoora burr leaf rust is effective only during days with warm summer drizzle.

Daisy burrs (*Calotis* spp.) may provide good feed during and after wet winters, but their seeds contaminate the fleece and make shearing unpleasant.

**Parthenium.** Parthenium could increase dramatically if introduced, for example in bought-in cattle, from migrating headers in cropping areas, or along the highway. Parthenium likes good clay soils, pasture land opened up by heavy grazing or by cropping and summer rainfall.

**Any parthenium plants seen should be sprayed or dug out immediately and reported to the local council.**

**Rolypoly.** Rolypoly is a common sight after droughts or in overgrazed paddocks. In the north, it is mostly *Amaranthus mitchelli* but *Salsola kali* is found throughout the region especially where cattle are run.

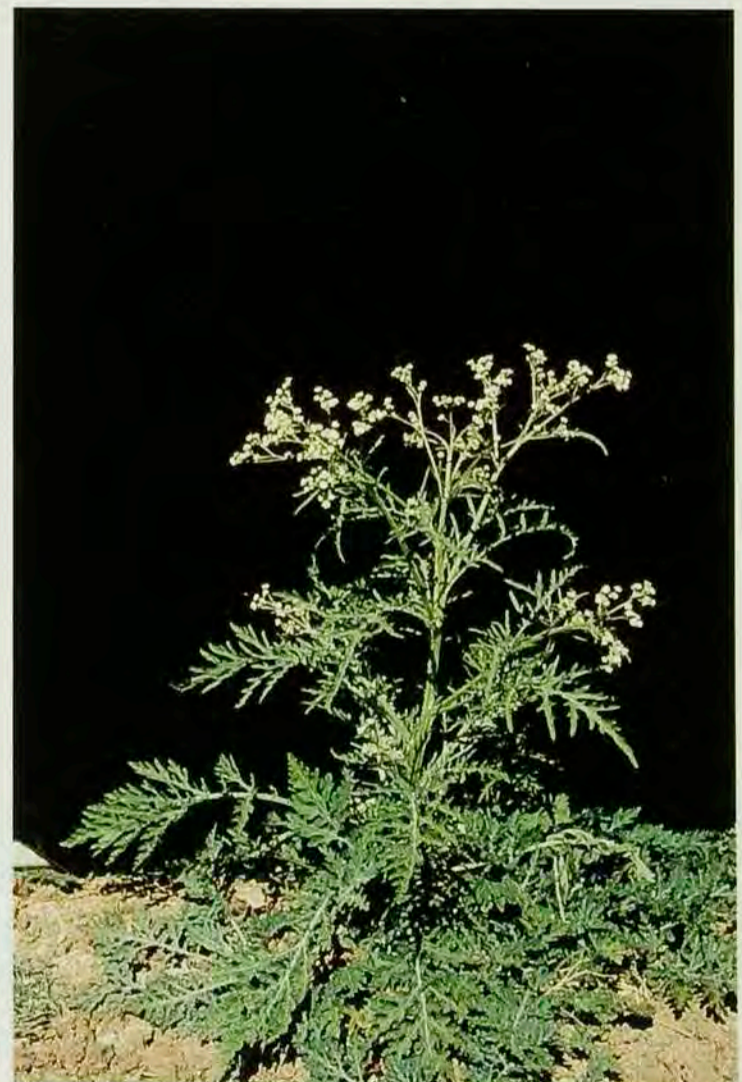
In the south and especially in gidgee areas, black rolypoly (*Sclerolaena muricata*) can be a disturbing sight, but it may be controlled by a period of light grazing during summer.



*Feathertop can be reduced by grazing with cattle. It becomes worse under light grazing with sheep in wet years*



*White speargrass in the south is encouraged by heavy grazing with sheep*



*Keep an eye out for parthenium weed*



*Mitchell grass pastures rarely need improvement unless a problem arises*



*Mitchell grass seed can be harvested, and sown into degraded pasture or old cropping land*



*Bambatsi and purple pigeon grass are often sown (separately) after the cropping phase*

## Improving mitchell grass country

Mitchell grass is an excellent native grass, very resilient to grazing and of moderately good feed value. With the associated forbs and legumes, pasture quality is such that improvement is rarely desirable, nor is it easy because of the low and unreliable rainfall.

However, the following problems can arise:

- mitchell grass can be grazed out under extreme pressure, with bare clay pans or scalds forming on some frontage soils
- protein droughts occur during winter or the dry season every year; they can also occur during the growing season after two wet years when the grass has exhausted available soil nitrogen
- the lack of shade can reduce animal performance during summer
- soil fertility has declined after mitchell grasslands have been cropped continuously in the south.

Pasture improvement is more common on smaller and more intensive properties in the south, especially where there is a mixture of land and native pasture types.

Improvement can include:

- reseeding with mitchell grass
- planting introduced grasses
- planting legumes
- planting fodders
- planting trees.

**Reseeding with mitchell grass.** After mitchell grass has been ploughed out, grazed out or shaded out, it will not come back without reseeding. Seed can be harvested with conventional headers or with the newer brush harvesters, but supply has been uncertain. Mitchell grass is not easy to establish from seed, and sowings must be made on a full profile of soil moisture after a fallow. Selections of curly mitchell with better seed production and seedling vigour are being developed by NSW Agriculture; locally harvested seed may be better adapted for more northern regions.

Renovating or disturbing established mitchell grass to release soil nitrogen usually kills the plants.

**Planting introduced grasses.** There is generally no point in replacing vigorous mitchell grass on the downs; however, pastures degraded with white speargrass may be ploughed out and cropped or replanted.

Purple pigeon grass and Bambatsi are usually sown into old cropping land in preference to mitchell grass because seed is cheaper and more productive in the short term. It is often better to sow these two grasses

in separate paddocks as Bambatsi is more palatable and may be grazed out.

**Some mitchell grass seed should be included in a mixture for a permanent pasture.**

**Planting legumes.** Mitchell grass pasture already contains a number of native legumes including rhynchosia, native glycines, and the *Psoralea* species—verbine and emu foot. Some are summer-growing; some, such as verbine, are unpalatable, whereas emu foot can provide high quality feed in early spring.

In the southern region, winter rainfall will produce growth of annual medics if they have been sown or have naturalised. Most common is the common burr medic, with cutleaf medic further west, and some woolly burr medic. These produce very high quality feed, especially in wetter winters, allowing stock to make better use of the dry grasses, and fixing some nitrogen for the summer-growing grasses. The burrs of all these medics can cause vegetable fault in wool, while dense stands can bloat and kill stock.

Lucerne and snail and barrel medic are legumes used for a ley break in cropping land. Lucerne may last for 4—5 years under rotational grazing, but needs good rainfall to be productive. Small falls of rain may produce little growth because lucerne will deplete soil moisture to a considerable depth.

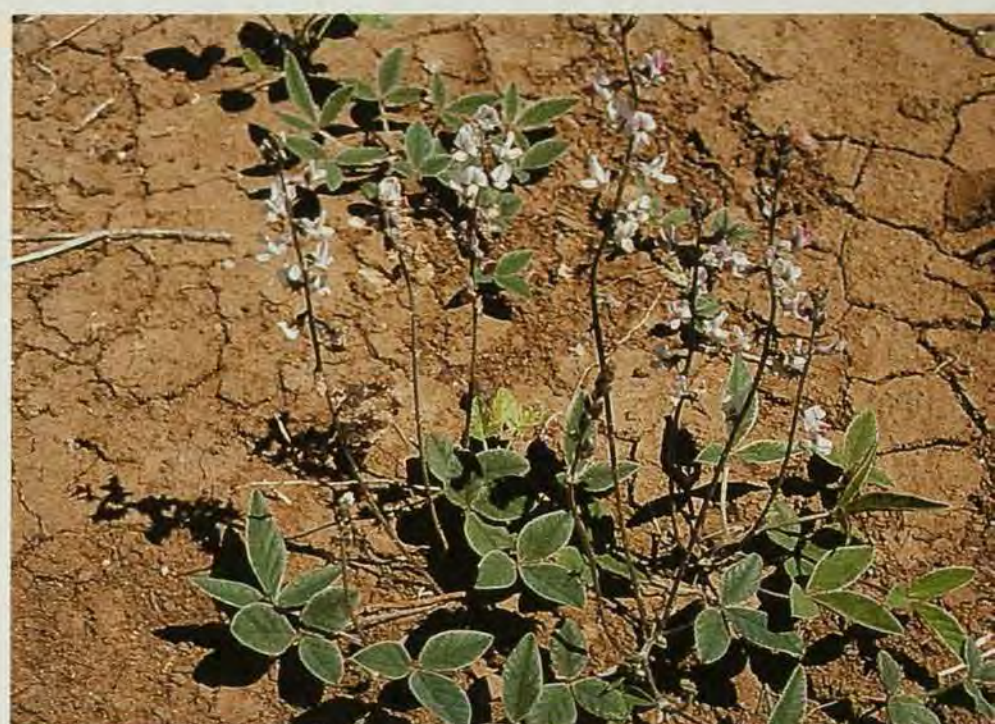
Snail medics are self-regenerating annuals providing feed only during winter and spring; they can be more productive than lucerne at this time as they can use soil water stored during the previous summer.

**Planting fodders.** Fodder crops are planted only in the southern, more intensive agricultural region where mixed farming is common, and where winter rains are more reliable. Fodder crops include oats in winter, and forage sorghums in summer.

**Planting trees for shade.** Any tree species planted for shade must not become the prickly acacia of the next century. Athel pine survives on the clay downs, can tolerate the salt in bore water and grows well; however, conservationists have labelled it a serious environmental weed because it has spread into sandy water courses in central Australia.

The best native species include emu apple, bauhinia, dogwood, beefwood, weeping myall, golden wattle and eucalypts such as snappy gum, red river gum and coolibah.

**All seedling trees will need protection and extra water during establishment.**



*Native or naturalised legumes improve the quality of grazing*



*Lucerne and medic leys will improve soil fertility after cropping*



*Stock seeking shade. New species of shade tree must not become a pest*

# Monitoring pastures

Monitoring is one of the three basic parts of managing a native pasture.

You need to understand:

- the ecology of the grassland
- follow sound local guidelines
- check (monitor) the effects of your management on your paddocks.

Monitoring encourages you to look more closely at the pasture, and it provides a record that you can use to detect gradual changes over the years.

This booklet does not tell you how to monitor because the various methods are described in another DPI publication – GRASS CHECK.

## ***What is the best way to monitor pastures?***

Monitoring pastures may seem a little daunting at first, but once tried, it is quite simple—and very interesting. Most graziers are keen to learn the names of more of the plants in their paddocks; recording is a good way to do it.

Monitoring becomes your own small research project in your paddock, not someone else's results from miles away. It is not time-consuming, taking only 1–2 hours for each site.

GRASS CHECK offers you a number of techniques, with varying levels of detail, for estimating the amount of herbage in the paddock, the ground cover, presence of desirable and undesirable species, and the density of woody weeds.

The simplest recordings are regular photographs of a number of sites; they show the changes that become obvious in time.

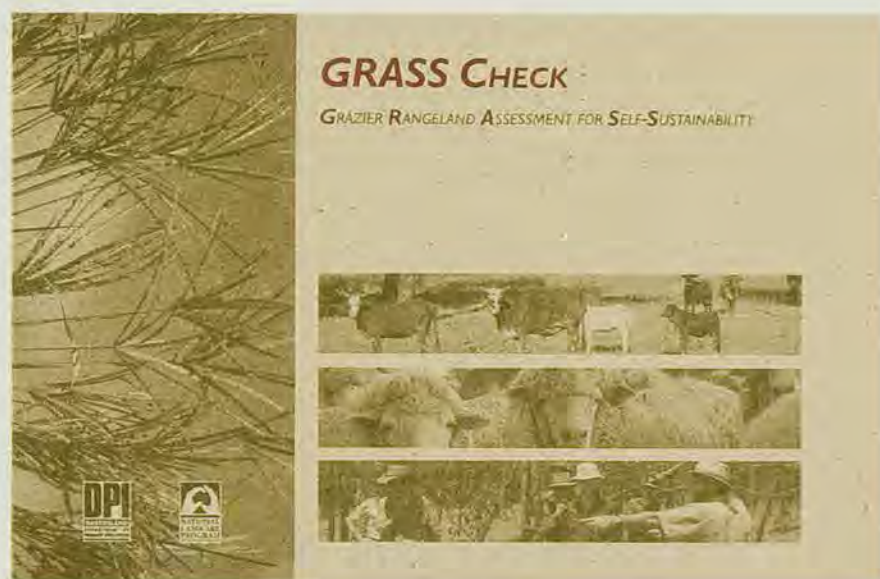
The DPI runs training workshops to explain and demonstrate the various methods described in GRASS CHECK.

## ***When is the best time to monitor pastures?***

Monitoring is best done at the end of the growing season, between April and June. This allows decisions to be made on adjusting stock numbers while animals and pastures are still in good condition.

## ***How can I identify the different plants?***

Many graziers have always been interested in plants but have found it difficult to identify the different species. Some of the more common grasses are shown in the next few pages of this booklet, but many more species are identified in two new DPI publications—***Plant Identification in the Arid Zone*** and ***Pasture Plants of Southern Inland Queensland***.



## Estimating feed in the paddock

You can estimate the amount of feed standing in the paddock either by direct measurement or by comparing with the photo-standards in this booklet. Accuracy comes with experience, but is best achieved with direct measurement by cutting quadrats, drying the herbage and weighing it on electronic kitchen scales.

## Photo-standards of Mitchell grass

The following photo-standards show the weights, as kg/ha, of standing *dry matter* — not of green material.

The extremes on this page are easy to assess, but then so are the resulting stocking decisions.



**3900 kg/ha  
dry matter**



**50 kg/ha  
dry matter**

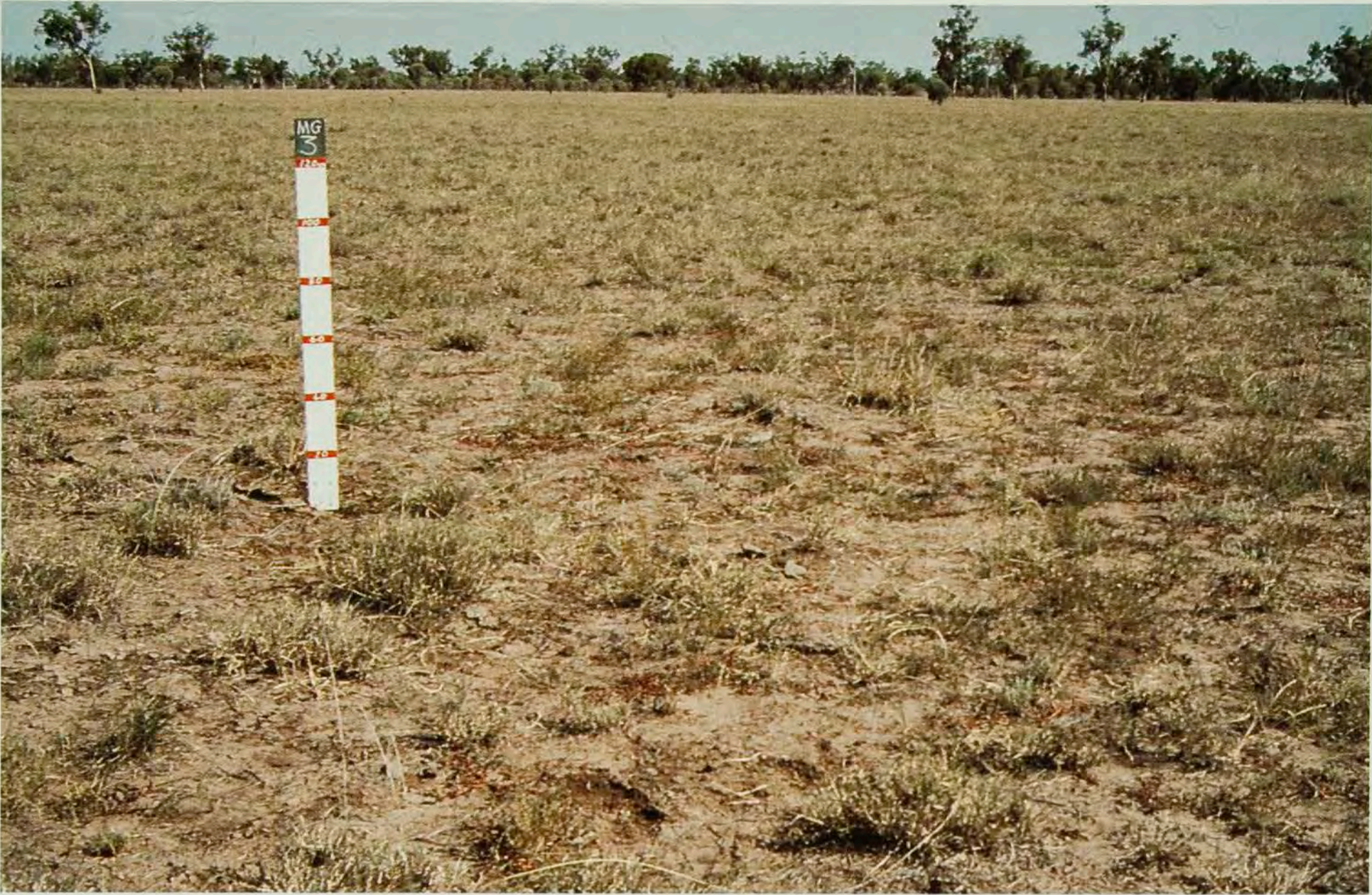




**2250 kg/ha dry matter**



**1000 kg/ha dry matter**



**700 kg/ha dry matter**



**150 kg/ha dry matter**

# Recognise the important grasses

## Desirable grasses

Curly mitchell grass  
Hoop mitchell grass  
Bull mitchell grass  
Barley mitchell grass  
Queensland bluegrass  
Desert bluegrass

*Astrebla lappacea* –  
*A. elymoides* =  
*A. squarrosa* –  
*A. pectinata* –  
*Dichanthium sericeum* =  
*Bothriochloa ewartiana*

## Intermediate value

Bottlewashers, nineawn  
Button grass  
Comb windmill grass  
Cup grass  
Desert couch  
Early spring grass  
  
Flinders grass  
Katoora  
Love grasses  
Native millets  
(Yabilla grass)  
Silky browntop  
Umbrella or blowaway grass

*Enneapogon* spp. +  
*Dactyloctenium radulans* +  
*Chloris pectinata*, *C. divaricata*  
*Eriochloa crebra* =  
*Brachyachne convergens* +  
*Enteropogon pseudoacrotricha* +  
*Enteropogon acicularis*  
*Iseilema species* +  
*Sporobolus actinocladius* +  
*Eragrostis setifolia* +  
*Panicum decompositum*  
*P. queenslandicum* +  
*Eulalia aurea* =  
*Digitaria coenicola*, *D. divaricatissima*

## Undesirable grasses

Burr grass  
Feathertop  
White speargrass  
Sedges

*Tragus australianus*  
*Aristida latifolia* =  
*Aristida leptopoda* +  
*Cyperus* spp., *Fimbristylis* spp.

(–) indicates that the species declines under heavy grazing  
(+) indicates that the species increases under heavy grazing  
(=) indicates that rainfall has more effect than grazing pressure.

## Some important forbs (non-woody broad-leaved plants—commonly termed 'herbage')

### Native legumes

Annual verbine  
Emu foot  
Indigos  
Native glycine  
Rhynchosia

*Psoralea cinerea*  
*Psoralea tenax*  
*Indigofera* spp  
*Glycine falcata*  
*Rhynchosia minima*

### Naturalised legumes

Common burr medic  
Cut-leaf medic  
Woolly burr medic  
(Other forbs are listed on page 40.)

*Medicago polymorpha*  
*M. laciniata*  
*M. minima*



Curly mitchell grass



Bull mitchell grass



Barley mitchell grass



Hoop mitchell grass



Queensland bluegrass



Desert bluegrass



Bottlewashers



Button grass



Desert couch



Native millet



Katoora



Umbrella or blowaway grass



Cup grass



Flinders grass



Comb windmill grass



Feathertop



White speargrass



Burr grass

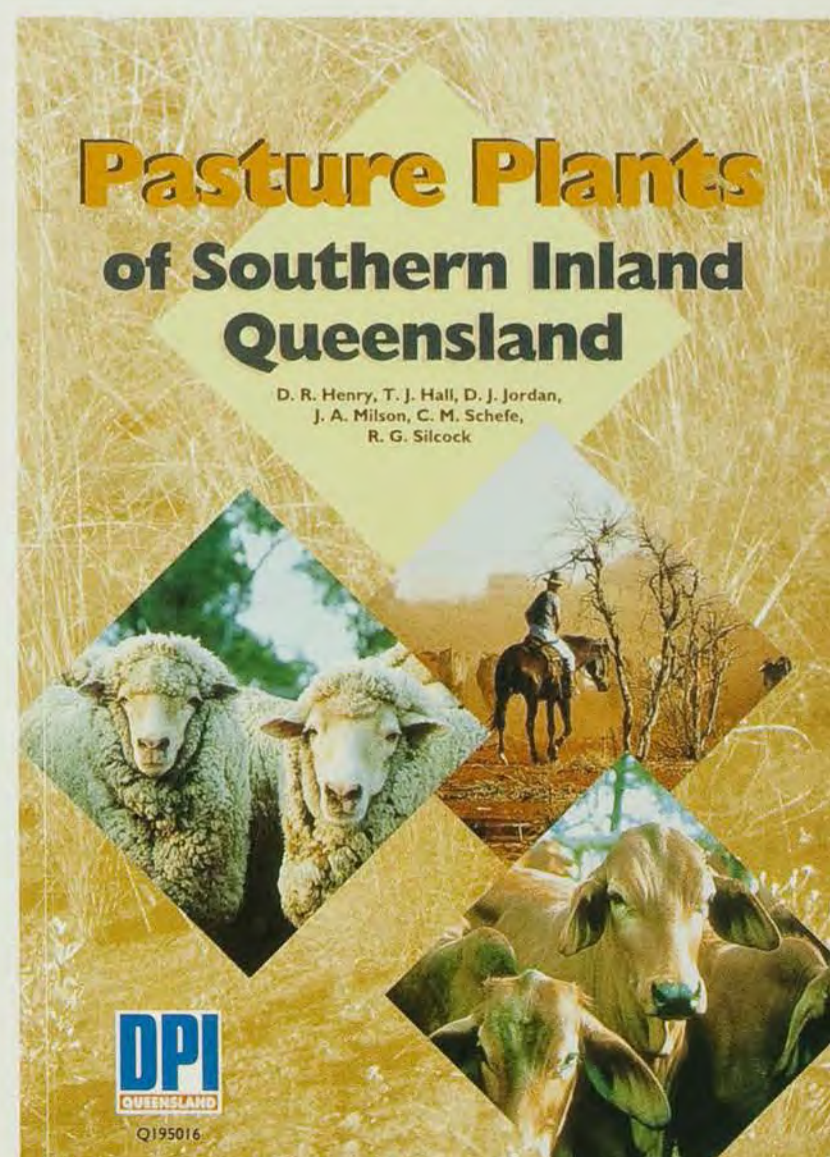
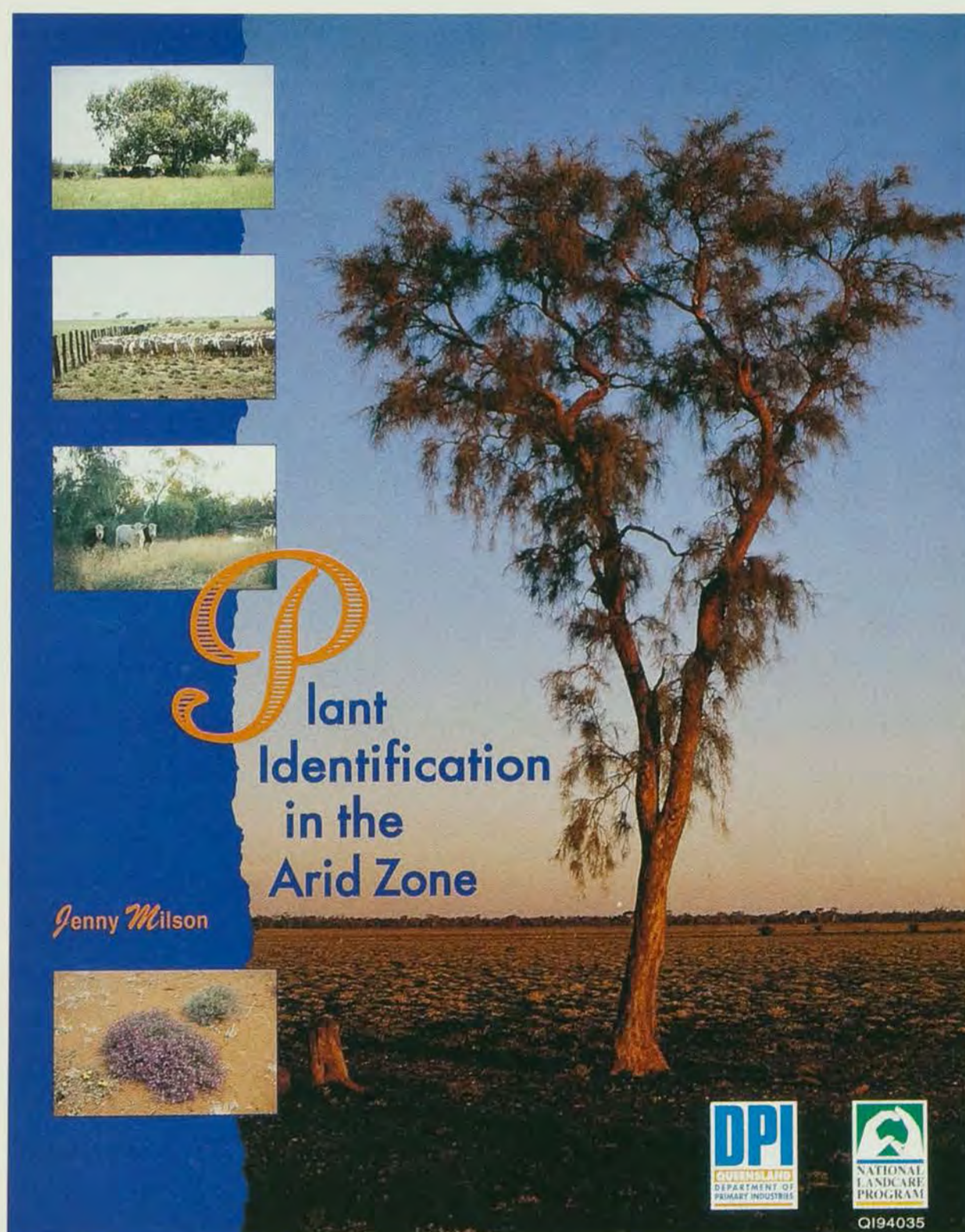
## Some important forbs

### Other forbs

Black roly-poly  
Cow vine  
Daisy burrs  
Malvastrum  
Potato bush  
Poverty bush, burr  
Saltbushes  
Soft roly-poly  
Tar vine

*Scleroleana muricata*  
*Ipomea lonchophylla*  
*Calotis* spp.  
*Malvastrum americanum*  
*Solanum esuriale*  
*Scleroleana* spp.  
*Atriplex* spp.  
*Salsola kali*  
*Boerhavia schomburgkiana*

These forbs and many others are illustrated in ***Plant Identification in the Arid Zone*** and ***Pasture Plants of Southern Inland Queensland***.



# How are your pastures?

You can rate the condition in your paddocks after monitoring. Condition can be categorised (on the proportion of the different species present and on the soil condition) into three states—good, deteriorating and degraded.

A ‘deteriorating’ pasture can be reversed to one in ‘good’ condition by changing management or by a return to more normal rainfall patterns.

‘Degraded’ land can be returned to its inherent productivity only by practices or expenditure outside normal management for this type of country.

# What ‘state’?

These states – ‘good’, ‘deteriorating’ and ‘degraded’ are simple descriptions. Pasture ecologists have developed the terms ‘state’ and ‘transition’ to describe more detailed changes in native pastures under various pressures. Pastures may be in a certain ‘state’ or moving between states ‘in transition’.

Some transitions may be reversed by changing management, others may need substantial and uneconomic inputs, for example mechanical clearing of prickly acacia. These states are described as:

## 'States' recognised for mitchell grass country

### State 1. Perennial tussock grasses

Good condition pasture dominated by desirable native perennial grasses having large tussocks, such as mitchell grasses and bluegrasses, plus annuals and forbs.

### State 2. Perennial-annual grasses

Deteriorating pasture dominated by a mixture of less desirable perennials and desirable tussock perennials having small tussock size, together with annuals and forbs. Typical common grasses are feathertop, white speargrass, native millets, flinders grass, soft rolypoly, malvastrum and downs couch.

### State 3. Annual grasses and forbs

Deteriorating pasture dominated by annual grasses and forbs with only undesirable perennials remaining. Typical species are button grass, native millet, pigweed and wiregrasses.

### State 4. Woody weed seed and seedlings yet to set seed.

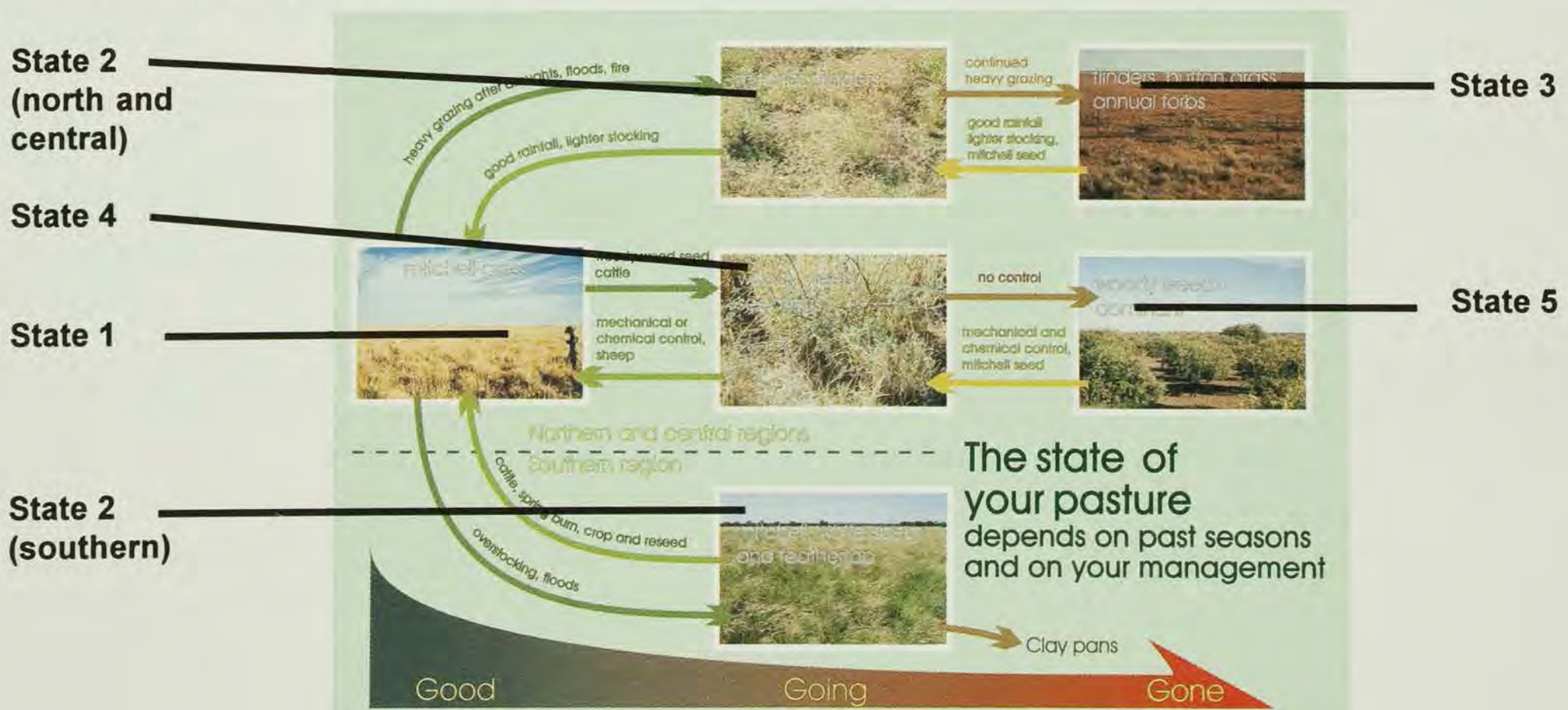
This can occur in vegetation states 1, 2, and 3 depending on rainfall events and level of seed introduction.

### State 5. Woody weed-dominant

Vegetation dominated by woody weeds requiring major interventions to remove.

Typical weeds are prickly acacia, algaroba, mimosa and parkinsonia.

These states, and the conditions and management that cause pastures to move from one state to another, are illustrated, for northern and southern mitchell grass regions, in the centre-fold, pages 18 and 19.





# Further reading

## General

*The pasture lands of northern Australia: their condition, productivity and sustainability* — John Tothill and Col Gillies (1992), Tropical Grasslands Society of Australia Occasional Publication No.5.

*Managing native pastures: a graziers guide* — Ian Partridge (1992), DPI Queensland.

*Sown Pasture Management Notes: Western Downs and Maranoa*— edited by David Lawrence and Vic French (1992), DPI Roma and Brisbane.

*Grazing lands management in the Maranoa: mitchell grass* — DN Lawrence, BK Slater, P Rowland and RA Clark (1991), Project Report QO91014 DPI Brisbane.

*State and transition models for rangelands* — Tropical Grasslands (1994) Vol. 28 No.4

## Mitchell grass

*Curly Mitchell grass* — Agfact P2.5.37, Alison Bowman (1992), NSW Agriculture.

*A review of *Astrebla* (Mitchell grass) pastures in Australia* — David Orr (1975), Tropical Grasslands Vol.9, No.1 pages 21–36.

*Mitchell Grasslands* — David Orr and Bill Holmes; Chapter 16 in *Management of Australia's Rangelands*— Ed. G N Harrington, A D Wilson, M D Young (1984), CSIRO Australia.

## Prickly acacia

*Prickly acacia: save dollars by early control measures* — by John Carter, M Bolton and Don Cowan (1989), Queensland Agricultural Journal, March – April 1989, pages 121–126.

*Prickly acacia management - what works?* Zara Field Day September 1994 — Compiled by Nathan March, Joe Rolfe and Don Cowan (1994), DPI Charters Towers.

*Prickly acacia Pestfact* — P009/93E/793P Land Protection Branch, Lands Office.

## Plant identification

*GRASS CHECK: Grazier Rangeland Assessment for Self-Sustainability* —by Karen Forge (1994), QI94005 DPI Brisbane.

*Pasture Plants of Southern Inland Queensland* — by R Henry, TJ Hall, DJ Jordan, JA Milson, CM Scheffe and RG Silcock (1995), DPI Brisbane.

*Plant Identification in the Arid Zone* —by Jenny Milson (1991), DPI Longreach.

*The Grasses of Southern Queensland* — by John Tothill and Bryan Hacker (1983), University of Queensland Press.

*Western grasses: a Graziers Guide to the Grasses of South West Queensland* — by Brian Roberts and Richard Silcocks (1993), USQ Press, Toowoomba.

## Decision support programs

*AUSTRALIAN RAINMAN: rainfall information for better management.* — JF Clewett, NM Clarkson and DT Owens (1994), DPI Brisbane.

*WOODY WEED ADVISER: options for woody weed management* — P Back, A Jamieson and G Lambert (1993), DPI Rockhampton.

*RANGEPAK HERDECON: a microcomputer-based Advisory System for Pastoral Land Management*— CSIRO National Rangelands Program, PO Box 2111, Alice Springs NT 0871.

*GRAZEON: total grazing management for mitchell grasslands* — by David Cobon (available 1996) DPI Longreach.

**M**anaging mitchell grass provides specific guidelines for mitchell grass pastures growing on large area of downs in inland Queensland and northern Australia. It is a local supplement to the basic principles described in *Managing native pastures: a grazier's guide*.

Written in a readable question and answer style, and illustrated with colour photographs, *Managing mitchell grass* describes the country and the management options for sustainable production.

These options include:

- setting stocking rates
- moving stock
- burning
- woody weed control
- improving the pasture.

The booklet also describes how monitoring mitchell grass pastures helps graziers to make effective management decisions.

ISBN 0 7242 5968 6

