

# Managing Tasmanian Native Pastures

*a technical guide for graziers*

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*A collaboration between:*

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## INTRODUCTION

Native pastures underpin the long-term productivity, profitability and sustainability of grazing activities on many Tasmanian properties, particularly fine wool grazing properties. They are also a significant vegetation community for conserving native plants and animals, and maintaining stable and healthy soils.

This guide provides information about managing native pastures in Tasmania. It has been written with input and involvement from Tasmanian graziers. It also includes the findings of relevant scientific Tasmanian field experiments, studies and surveys.

This guide was written in response to concerns from land managers who wanted to learn more about best management practices for native pastures in Tasmania. However, there are no fixed recipes for managing native pastures. In fact, adopting different and diverse management practices is the most useful approach, particularly for conserving biodiversity.

The aim of this guide is to provide information that will help you manage native pastures. The emphasis is on the conservation and sustainable management of these semi-natural ecosystems in the context of a productive farm enterprise. Sheep grazing on native pastures can maintain and enhance biodiversity values. Therefore, good grazing management will provide benefits for you *and* the broader community.

The first two chapters provide background information on native pastures in Tasmania, and describe the attributes of the key plant species.

The third chapter covers property planning, which forms the basis of all decision making. Management decisions concerning native pastures inevitably involve grazing management, which is covered in the fourth chapter.

A range of other issues associated with managing native pastures is addressed in subsequent chapters. These include using fertiliser, controlling weeds, using fire, maintaining conservation values, promoting tree and shrub regeneration, managing riparian and wetland areas, and managing native pastures during drought.

The guide concludes with information about monitoring native pastures, so you can assess the effect of your management practices on your pastures.

'Grazier viewpoints' and quotations from unnamed graziers have been included throughout the book to complement the main text. They highlight Tasmanian graziers' experiences of managing native pastures. The quotations have been taken from meetings and interviews. Quotations taken from published works have been cited.

“ *Native grasslands are Australia's most poorly conserved ecosystems.*

*Graziers with native grasslands have a unique asset.* ”

*David Kemp, 2002*

# 1

## Tasmania's Native Pastures



### KEY POINTS

- » Tasmania has several different types of native pasture.
- » Native pastures provide reliable and valuable low-input production.
- » Native pastures provide benefits for livestock health and wool quality.
- » Native grasses help maintain healthy soils and ecosystems.
- » Native pastures have high value for biodiversity conservation.
- » Some of Tasmania's most threatened plant and animal species are found in native pastures.

## Chapter 1 Tasmania's Native Pastures

### WHAT IS NATIVE PASTURE?

The terms 'native pasture', 'natural pasture' and 'native grassland' are all terms used to describe grazing environments dominated by native grasses. Native pastures may contain other native herbs as well as introduced plants, such as clovers, broadleaf weeds and annual grasses. Native pastures also occur in areas with scattered trees and shrubs. Tasmanian graziers often refer to these pastures as bush runs or run country, while ecologists refer to them as grassy woodlands. Native pastures are generally found on hilly, stony or wooded country where it has not been possible to sow introduced grasses, such as perennial ryegrass and cocksfoot.

There is a gradation in the composition of native pastures, from native pastures with many native species and few introduced species, to sown pastures containing few native species. Some native pastures have been top dressed and aerially seeded with pasture species, and may be referred to as semi-improved pastures. Others have been ploughed in the past, and have reverted to native species and may be referred to as 'degraded' or 'run out' pastures. Other native pastures were previously wooded country, but the trees have been lost through ringbarking and rural tree decline. The point at which a native pasture is no longer native is arbitrary. However, in general, if native grasses dominate the vegetation cover, it is called a native pasture. To determine whether a pasture is native or not, it is necessary to identify the main grasses present to determine whether they are native species. (See Chapter 2 for descriptions of species.)



*Native pastures in good condition have a high native plant cover and comprise a variety of species.*

Healthy native pastures in excellent condition are characterised by high biodiversity. These pastures contain a mixture of native grass species, including kangaroo grass, wallaby grasses, weeping grass, tussock grasses, speargrasses and wheatgrass. The inter-tussock spaces (gaps between the grass tussocks) provide habitat for a variety of wildflowers, including peas, daisies, lilies and orchids, as well as sedges and rushes. Clovers and weedy introduced species are also likely to occur, but, in pastures in good condition, their cover and biomass are low. Scattered trees and shrubs may also be present. Cryptogams (lichens, algae and mosses) cover the bare areas of soil, and help to protect the soil from erosion.

*“ Sustainable and hence profitable production will only be achieved through better management of native grassland communities, not through their destruction. ”*

*Christine Jones, 1995*



## VALUE OF NATIVE PASTURES

As many as half the sheep in Tasmania graze on native pastures. Native pastures are important for many fine wool enterprises and are valued for being low-input pastures. They produce strong, fine wool due to their relatively even growth and minimal variation in nutritional value through the year compared with sown pastures. Sheep grazed on native pastures have fewer worm infestations and need less frequent drenching than those on sown pastures. Sheep fly strike is also far less common on native pastures than sown pastures. Native tussock grass (*Poa* spp.) and sagg (*Lomandra longifolia*) provide shelter for livestock. Native pastures usually carry less sheep per hectare than sown pastures, but require less time and cost inputs, such as resowing. In addition, graziers see them as aesthetically pleasing landscapes in which to live and work.

“ Native pastures provide feed with a constant nutritional value through the year, and so you can grow wool on it with a very even fibre diameter. ”

The grasses in native pastures are adapted to the Tasmanian environment, being both drought and frost tolerant. Native grasses, like wallaby grasses and weeping grass, are productive, highly palatable and responsive to increased soil fertility. They are resilient to pasture pests, such as corbies (*Oncopera* spp.) and pasture cockchafers (*Aphodius* spp.). Most of Tasmania’s native grass species are perennial, so they play an important role in maintaining soil health. During summer and autumn, they protect the soil from erosion and reduce the risk of salinisation by using water from deep in the soil profile.

Native pastures are a high priority for conservation. Approximately 750 native species occur in Tasmania’s native pastures, and the most diverse sites have as many as 60 species per 10 m<sup>2</sup>. Over 20 grassland species are listed as threatened, including the grassland paperdaisy (*Leucochrysum albicans*), leafy greenhood (*Pterostylis cycnocephala*) and grassland candles (*Stackhousia gunnii*). Many grassland animals are also threatened, including the glossy grass skink (*Pseudemoia rawlinsoni*), Ptunarra brown butterfly (*Oreixenica ptunnara*) and the large flightless beetle (*Catadromus lacordairei*).



Native pastures are important for conservation of threatened species, including these grassland paperdaisies.



### WHAT WERE NATIVE PASTURES LIKE ORIGINALLY?

Today's native pastures are derived from the grasslands and grassy woodlands present at the time of European settlement (Figure 1). Extensive lightly wooded, grassy plains were common along the valley floors and river flats of the Midlands and Derwent Valley. With their productive soils, these areas were readily suited to settlement and agriculture. Early colonial paintings and old survey maps reveal the original landscape, and place names, such as Ellinthorp Plains, Henrietta Plains and Wyldes Plain, tell us where the grasslands and grassy woodlands occurred.

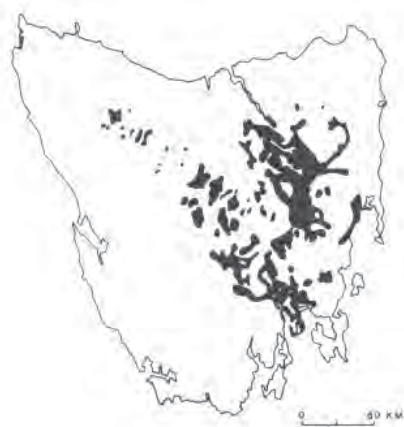


Figure 1. Distribution of grasslands and grassy woodlands in Tasmania in 1800 (from Kirkpatrick et al. 1988).

The early settlers' descriptions of the grasslands and grassy woodlands indicate that the native grasses were taller and lusher, wildflowers were more prolific, and soils were richer and more friable than today. The decline in small mammals, absence of Aboriginal digging for edible roots, introduction of domestic hard-hooved livestock, altered fire regimes, and establishment of introduced plants since settlement are all factors that help explain the changes seen in native pastures in the last 200 years.

### TYPES OF NATIVE PASTURE

We can identify several types of native pasture in Tasmania. The two main types are lowland native pastures, which occur below 700 m altitude, and highland native pastures, which occur above 700 m altitude. This guide is primarily concerned with lowland native pastures. Broad descriptions of each lowland pasture type follow.

*“ The feed native pastures provide isn't conducive to scouring, so you can put sheep on native pasture and know that they're not going to get dirty. ”*

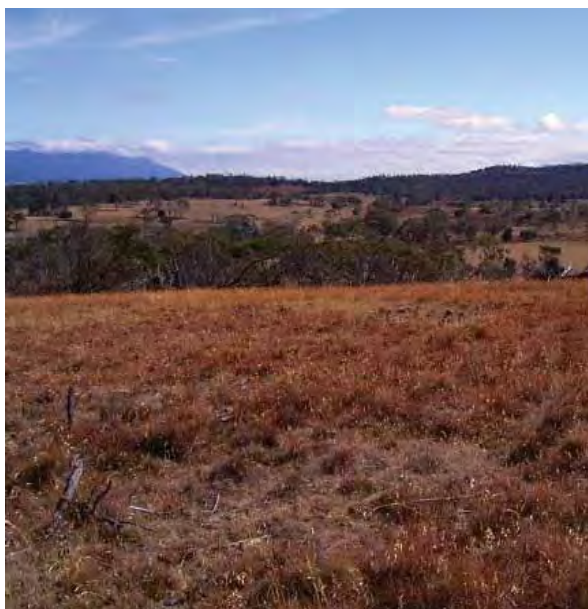


*Native wildflowers will persist in native pastures under favourable management.*

### Kangaroo grass pastures

Kangaroo grass pastures are dominated by kangaroo grass (*Themeda triandra*), but contain other native grasses and wildflowers. They are quite distinctive and have a reddish colour in autumn. Pastures dominated by kangaroo grass have not been sown with introduced grasses or clovers, and have received little or no fertiliser.

Kangaroo grass pastures are stocked at low stocking rates (e.g. 1–2 DSE/ha) or rested regularly. Kangaroo grass grows during the warm season, so it complements the cool season grasses, such as wallaby grass (*Austrodanthonia* spp.) and weeping grass (*Ehrharta stipoides*), and provides an alternative food source for livestock in summer.



*Kangaroo grass pastures display a distinctive reddish colour in autumn.*

### Tussock grass pastures

Tussock grass pastures are the easiest native pastures to identify because of the obvious presence of the tussock grasses (*Poa* spp.). The pasture between the tussocks can be made up of native grasses and other herbs, or introduced clovers, grasses and broadleaf weeds.

Tussock grass is the main type of riparian vegetation on moist soils along rivers and their adjacent floodplains. Many graziers value tussock grass pastures as shelter for lambing ewes or newly shorn sheep.



*Many graziers value tussock grass pastures as shelter for lambing ewes.*

### Wallaby grass pastures

Wallaby grass pastures are dominated by wallaby grasses, but may also contain native tussock grasses or kangaroo grass. Other native grasses may also be present, including weeping grass, rough wheatgrass (*Elymus scaber*) and native speargrasses (*Austrostipa* spp.). Wallaby grass pastures often contain clovers, annual grasses and broadleaf weeds.

Wallaby grass pastures have usually been subjected to heavier stocking rates, and have often been fertilised in the past. They are considered to be the most productive native pastures for grazing.



*Wallaby grass pastures are the most productive native pastures for grazing.*



## Chapter 1 Tasmania's Native Pastures



### Bush runs

Bush runs, also referred to as 'run country' or 'rough grazing country', are treed areas dominated by shrubs, native grasses, sags, sedges, lilies, daisies and other native herbs. The most common trees are white gum (*Eucalyptus viminalis*), cabbage gum (*E. pauciflora*) and black gum (*E. ovata*). The main native grasses present include kangaroo grass, wallaby grasses and native speargrasses. Bush runs are the most extensive type of native pasture. They are usually found on shallow stony soils in hilly areas too steep and rough to develop.



*Bush runs are the most extensive type of native pasture.*

# 2

## Key Native Pasture Species in Tasmania



### KEY POINTS

- » Identifying the key species in native pastures is essential for good pasture management.
- » Healthy native pastures contain a mixture of dominant native grasses and a variety of wildflowers.
- » Native grasses recover well if allowed adequate time to recover after grazing.
- » Kangaroo grass declines in response to overgrazing and fertiliser.
- » Wallaby grasses and weeping grass are the most productive and nutritious native grasses.

### IMPORTANCE OF IDENTIFYING SPECIES IN NATIVE PASTURES

Being able to recognise the important species and knowing how to maintain and encourage desirable species is essential for good native pasture management. Knowing the species present enables you to determine the condition of your pasture, and allows you to implement management practices that encourage desirable species and discourage undesirable species.

This chapter provides basic information on the more important species in Tasmanian native pastures. More detailed information can be obtained from *Common grasses of Tasmania: an agriculturalists' guide* by P. Lane, D. Morris and G. Shannon, 1999 and *The glove-box guide to grass and legume identification in Tasmanian pastures* by J. Knox, 1998.

Table 1 (overleaf) lists the species found in a native pasture at Nile in northern Tasmania. It gives a good indication of the range of species found in native pastures.

### NATIVE PERENNIAL GRASSES

Native perennial grasses are the most important component of native pastures. They are adapted to the Tasmanian environment, so they can survive during periods of low and unreliable rainfall. They also play an important role in maintaining ground cover. High (more than 70%) perennial plant cover can reduce soil erosion, and limit or prevent invasion of annual grasses and broadleaf weeds.

Some perennial native grasses, such as wallaby grasses and weeping grass, can produce similar quantities and quality of herbage as sown pastures when grown under the same conditions.

Although native grasses are generally palatable and productive, they are vulnerable to overgrazing. If allowed adequate time to recover after grazing, they regenerate well. However, continuous grazing reduces their capacity to recover and they may be eliminated.

Native grasses are slow to recolonise an area when greatly diminished in number, because they generally produce few seeds and have limited soil seed banks. Table 2 (Friend *et al.* 1997a) shows the size of the soil seed banks of native grasses compared with those of introduced grasses (mainly annual species) and other species in a native pasture at Nile, Tasmania.

Some native grasses, such as kangaroo grass and tussock grasses, which were abundant in the pasture at Nile (Table 1), produced few seedlings for recruiting new plants (Table 3). The wallaby grasses in the pasture at Nile produced more seedlings than the other grasses (Table 3), but these seedlings were under considerable stress due to competition from other plants, low soil moisture, grazing and trampling, so many died before maturation.

Native grass seedlings in established pastures need bare areas created by grazing and other disturbances to survive. In the absence of disturbance, native grasses rely on the survival of established plants to maintain their populations.

Table 2. Soil seed banks in a kangaroo grass pasture at Nile, Tasmania.

Species group	Number of seeds/m <sup>2</sup> *
Native grasses	350
Introduced grasses	5,460
Native broadleaf species	380
Introduced broadleaf species	3,530
Native and introduced sedges, rushes and other monocots	9,060

\* Average of estimates for 1994 and 1995

**Kangaroo grass (*Themeda triandra*, formerly *Themeda australis*)**

Kangaroo grass is the first of the prominent native grass species to disappear when grazing intensity and soil fertility increase. As a result, it is found mainly in ungrazed areas, such as along roadsides, and in pastures that have been rested regularly or stocked lightly, particularly in summer.

Kangaroo grass grows mainly in late spring to early autumn. It is drought resistant, and its deep roots allow it to reach deep into the soil profile. The young leaves are palatable and have moderate to high forage value. However, the mature leaves have low palatability and low forage value. Therefore, it is most suited to less nutritionally demanding production systems such as merino wethers.

Kangaroo grass is dormant over winter, because it is sensitive to frost. However, New South Wales researchers have reported that heavy grazing before winter makes the regrowth more frost resistant, allowing it to remain green well into winter. Kangaroo grass may decrease in abundance following the application of fertiliser, because it does not compete well with clovers and other grasses when soil fertility is high.

See page 47, 'Year-round management of kangaroo grass pastures' for more specific grazing management guidelines.



Kangaroo grass (above), with flower head (top).

Table 3. Establishment and survival of seedlings of five species of native grass in a kangaroo grass pasture at Nile, Tasmania.

Species	Year	New seedlings establishing (No./m <sup>2</sup> )	Percentage survival of seedlings to			
			Sept. 1995	Sept. 1996	Sept. 1997	Sept. 1998
Kangaroo grass	1994	0.33	50	50	50	50
	1995	0.16	-	0	0	0
	1996	0.08	-	-	0	0
Wallaby grasses	1994	7.83	47	37	29	23
	1995	3.75	-	47	21	21
	1996	26.87	-	-	26	19
Weeping grass	1994	0.92	27	18	18	18
	1995	0.50	-	74	42	34
	1996	0.50	-	-	50	0
Rough wheatgrass	1994	0.25	68	68	34	34
	1995	1.17	-	68	25	11
	1996	2.92	-	-	9	1
Tussock grasses	1994	0.00	-	-	-	-
	1995	0.00	-	-	-	-
	1996	0.00	-	-	-	-



## Chapter 2 Key Native Pasture Species in Tasmania

Table 1. Species recorded in a 1 hectare area of a kangaroo grass pasture at Nile, Tasmania

Species group	Species	Common name	Relative abundance <sup>1</sup>
Native grasses			
	<i>Austrodanthonia</i> spp.	Wallaby grasses	A
	<i>Austrostipa</i> spp.	Speargrasses	R
	<i>Dichelachne</i> spp.	Plume grasses	R
	<i>Ehrharta stipoides</i>	Weeping grass	A
	<i>Elymus scaber</i>	Rough wheatgrass	C
	<i>Pentapogon quadrifidus</i>	Five-awned speargrass	O
	<i>Poa labillardierei</i>	Silver tussock grass	A
	<i>Poa rodwayi</i>	Velvet tussock grass	C
	<i>Poa</i> spp.	Tussock grasses	R
	<i>Themeda triandra</i>	Kangaroo grass	A
Perennial grass weeds			
	<i>Agrostis capillaris</i>	Browntop bent	R
	<i>Anthoxanthum odoratum</i>	Sweet vernal grass	A
	<i>Holcus lanatus</i>	Yorkshire fog	R
	<i>Lolium perenne</i>	Perennial ryegrass	R
Annual grass weeds			
	<i>Aira caryophyllea</i>	Silvery hairgrass	A
	<i>Briza minor</i>	Lesser quaking-grass	C
	<i>Bromus hordeaceus</i>	Soft brome	C
	<i>Hordeum murinum</i>	Shortflower barley grass	R
	<i>Vulpia</i> spp.	Squirrel- & rats-tail fescues	C
Clovers			
	<i>Trifolium repens</i>	White clover	R
	<i>Trifolium</i> spp.	Clovers	A
	<i>Trifolium subterraneum</i>	Subterranean clover	C
Native lilies and broadleaf species			
	<i>Acaena echinata</i>	Shiny sheepburr	O
	<i>Arthropodium minus</i>	Small vanilla lily	R
	<i>Asperula conferta</i>	Common woodruff	R
	<i>Bossiaea prostrata</i>	Creeping bossia	R
	<i>Bulbine bulbosa</i>	Golden bulbine-lily	R
	<i>Chrysocephalum apiculatum</i>	Common everlasting	R
	<i>Convolvulus angustissimus</i>	Blushing bindweed	R
	<i>Crassula sieberana</i>	Rock stonecrop	R
	<i>Diuris</i> sp.	Donkey orchid	R
	<i>Dichondra repens</i>	Kidneyweed	R
	<i>Drosera</i> spp.	Sundew	O
	<i>Eryngium vesiculosum</i>	Prickfoot	R
	<i>Euchiton</i> spp.	Cudweeds	C
	<i>Galium</i> spp.	Bedstraw	R
	<i>Geranium solanderi</i>	Southern cranesbill	O
	<i>Glycine latrobeana</i>	Clover glycine	R
	<i>Gonocarpus</i> spp.	Raspworts	R
	<i>Hibbertia</i> spp.	Guinea flowers	O
	<i>Hypericum gramineum</i>	Small St Johns-wort	R
	<i>Hypoxis hygrometrica</i>	Golden weather-grass	O

Table 1 (cont). Species recorded in a 1 hectare area of a kangaroo grass pasture at Nile, Tasmania

Species group	Species	Common name	Relative abundance <sup>1</sup>
Native lilies and broadleaf species continued			
	<i>Leptorhynchos squamatus</i>	Scaly buttons	C
	<i>Lissanthe stigosa</i>	Peachberry heath	R
	<i>Microtis unifolia</i>	Common onion-orchid	R
	<i>Oxalis perennans</i>	Grassland woodsorrel	O
	<i>Pimelea humilis</i>	Dwarf rice flower	O
	<i>Plantago varia</i>	Variable plantain	O
	<i>Poranthera microphylla</i>	Small poranthera	R
	<i>Ranunculus</i> spp.	Buttercups	R
	<i>Solenogyne dominii</i>	Smooth flat-herb	A
	<i>Veronica</i> spp.	Native speedwells	O
	<i>Wahlenbergia</i> spp.	Bluebells	O
	<i>Wurmbea dioica</i>	Early nancy	O
Sedges and rushes			
	<i>Carex</i> spp.	Sedges	C
	<i>Juncus bufonius</i>	Toad rush	R
	<i>Juncus capitatus</i>	Rush	R
	<i>Juncus</i> spp.	Rushes	O
	<i>Lomandra nana</i>	Dwarf mat-rush	R
	<i>Luzula densiflora</i>	Dense woodrush	R
	<i>Luzula</i> sp.	Woodrush	R
	<i>Schoenus absconditus</i>	Hidden bog-sedge	A
	<i>Schoenus apogon</i>	Common bog-sedge	R
Broadleaf weeds			
	<i>Acetosella vulgaris</i>	Sheep sorrel	R
	<i>Aphanes arvensis</i>	Parsley piert	R
	<i>Arctotheca calendula</i>	Capeweed	R
	<i>Carduus</i> spp.	Slender thistle	R
	<i>Centaureum erythraea</i>	Common centaury	R
	<i>Cerastium glomeratum</i>	Mouse ear chickweed	O
	<i>Cirsium vulgare</i>	Spear thistle	R
	<i>Hypochoeris glabra</i>	Smooth cats-ear	O
	<i>Hypochoeris radicata</i>	Cats-ear	A
	<i>Leontodon taraxacoides</i>	Hawkbit	A
	<i>Moenchia erecta</i>	Erect chickweed	O
	<i>Myosotis discolor</i>	Forget-me-not	R
	<i>Parentucellia latifolia</i>	Broadleaf glandweed	R
	<i>Plantago coronopus</i>	Bucks-horn plantain	R
	<i>Plantago lanceolata</i>	Ribwort plantain	R
	<i>Rumex</i> spp.	Docks	R
	<i>Sagina apetala</i>	Annual pearlwort	R
	<i>Silybum marianum</i>	Variiegated thistle	R
	<i>Taraxacum officinale</i>	Dandelion	R
Woody weeds			
	<i>Ulex europaeus</i>	Gorse	R

<sup>1</sup> A = abundant, C = common, O = occasional, R = rare

## Chapter 2 Key Native Pasture Species in Tasmania

### Tussock grasses (*Poa* spp.)

Silver tussock grass (*Poa labillardierei*) is the most common native tussock species in Tasmania, and it forms large coarse tussocks. It favours damp situations, such as drainage lines, but is also found on drier hillsides. Velvet tussock grass (*Poa rodwayi*) is common but less abundant than silver tussock grass. It is softer and less coarse than silver tussock grass. Other tussock grasses comprise only minor components of native pastures.



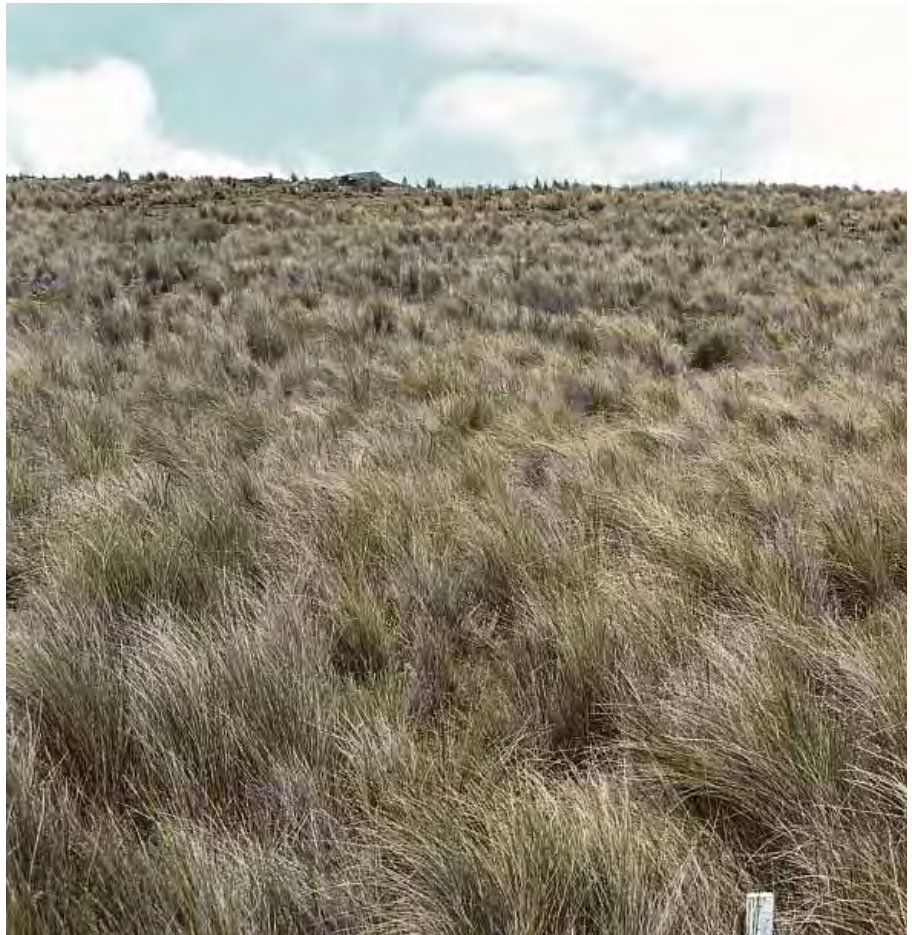
Silver tussock (above and right), with flower head (top).

Tussock grasses are valuable pasture grasses in Tasmania. They provide shelter and drought fodder for livestock, and help maintain healthy soils. They respond well to fertiliser, and can take up nutrients and grow at the expense of other native grasses, such as kangaroo grass.

Tussock grasses have high growth rates, and are highly drought and frost tolerant. They have low palatability and digestibility. However, after mob stocking, slashing or fire, the new growth is grazed readily. Velvet tussock grass is more palatable than silver tussock grass, but does not tolerate overgrazing.

Overgrazing of tussock species, especially during drought, can reduce their abundance or eliminate them entirely. Many Tasmanian graziers value tussock grasses for the shelter they provide for lambs and newly shorn sheep. Tussocks are also valued along watercourses, where they provide shelter for aquatic animals and protect the stream banks from erosion.

“ Tussocks provide great shelter for ewes and lambs at lambing time, and for sheep off shears, so we really value them at these times of the year. ”





**Wallaby grasses**  
(*Austrodanthonia* spp.,  
formerly *Danthonia* spp.)

Twenty-two species of wallaby grass occur in Tasmania, and they are among the most valuable native grasses due to their persistence, palatability, high forage value and productivity.



Wallaby grass (above and right), with flower head (top).

Wallaby grass pasture is the most widespread and abundant of the native pastures in the Midlands, Derwent Valley and East Coast of Tasmania. However, they were probably only a minor component of the original pastures in these regions. Six species of wallaby grass are common in these regions (*Austrodanthonia caespitosa*, *A. carphoides*, *A. penicillata*, *A. pilosa*, *A. racemosa*, *A. setacea*).

Wallaby grasses grow throughout the year when soil moisture is adequate. The common wallaby grasses tolerate heavier grazing than kangaroo grass and tussock grasses. They can become dominant in closely grazed swards, and can re-establish in sown pastures when the sown species fail to persist.

Despite their tolerance of heavy grazing, they respond well to strategic grazing and resting (see page 47 'Year round management of wallaby grass pastures'). Wallaby grasses tolerate low fertility soils, but also respond well to added fertiliser. However, under high fertility conditions, the abundance and cover of wallaby grasses may be reduced by increased competition from introduced species, such as clovers, annual grasses and broadleaf weeds.



## Chapter 2 Key Native Pasture Species in Tasmania

### Weeping grass (*Ehrharta stipoides* or *Microlaena stipoides*)

Weeping grass was probably only a minor component of pre-settlement pastures, but has become more common due to increased grazing and soil fertility.



*Weeping grass (above), with flower head (top).*

Weeping grass tolerates shade, and is commonly found beneath tree canopies and in lightly timbered areas. It also commonly occurs in heavily grazed, high fertility situations, such as on the edges of sheep camps. It can grow throughout the year, and has high forage value, high drought resistance and moderate frost tolerance. It can also grow in relatively acidic soils. Weeping grass tolerates a range of grazing regimes, but responds well to periodic resting.



*Careful management has maintained the dominance of wallaby grasses and weeping grass in this fertilised native pasture.*



### Rough wheatgrass (*Elymus scaber*)

Rough wheatgrass is a common but usually minor component of native pastures. It provides very palatable and high quality forage. However, it does not tolerate grazing as well as wallaby grasses and weeping grass due to its upright growth habit. Rough wheatgrass is a relatively short-lived perennial grass. Most of its growth occurs in autumn, winter and spring. It is unaffected by frost, and is moderately drought tolerant. Rough wheatgrass declines under intensive grazing, so is likely to benefit from rotational grazing.



Rough wheatgrass (above), with flower head (top).

### Native speargrasses (*Austrostipa* spp., formerly *Stipa* spp.)

Thirteen species of native speargrass occur in Tasmania. They are not usually major components of native pastures, even though several species are common, including *Austrostipa nodosa*, *A. stuposa* and *A. mollis*. *Austrostipa* spp. provide moderate to low value stock feed. Like the other native perennial grasses, they are highly frost and drought tolerant. Native speargrasses decrease in abundance in response to grazing, although tolerance to grazing varies between species. They seed freely, recruit well and can be good colonisers. The awned seeds can cause livestock damage and wool contamination, but heavy grazing during early flowering reduces the production of seed heads.



Native speargrass (above), with flower head (top).



Speargrass dominant native pasture.



## Chapter 2 Key Native Pasture Species in Tasmania

### NATIVE LILIES AND BROADLEAF SPECIES

Common native lilies include vanilla lilies (*Arthropodium* spp.), golden bulbine-lily, spreading flaxlily (*Dianella revoluta*) and early Nancy. Common native broadleaf species include grassland woodsorrel, native flat-herbs (*Solenogyne* spp.), scaly buttons, blue bottledaisy (*Lagenophora stipitata*), common everlasting, cudweeds, variable plantain, blushing bindweed, kidneyweed, sundew, buzzy (*Acaena* spp.), creeping bossia, native cranesbill (*Geranium* spp.), small St Johns-wort and pussytails (*Ptilotus spathulatus*).

Many native lilies and broadleaf species are selectively grazed due to their high palatability compared with the dominant grasses, so they often disappear from heavily grazed native pastures. However, some native broadleaf species are most abundant in grazed pastures, where they colonise areas of bare ground.

Native lilies and broadleaf species are generally less common in fertilised native pastures, where they are replaced by introduced annual grasses and clovers.



*Glycine clover (Glycine latrobeana)*



*Vanilla lily (Arthropodium sp.)*



*Golden bulbine lily (Bulbine bulbosa)*

### SAGG, SEDGES AND RUSHES

Sagg (*Lomandra longifolia*), sedges (*Schoenus* spp., *Isolepis* spp.), sword-sedges (*Lepidosperma* spp.), woodrushes and rushes are often associated with damp, poorly drained and wooded areas. Sagg and rushes are coarse and unpalatable, but are grazed for roughage. Some sedges are readily grazed, and may be difficult to distinguish from grasses in native pastures.

Sagg and rushes can provide shelter for livestock, and may protect regenerating trees and shrubs. They may also invade native pastures, increasing their abundance at the expense of more productive pasture species. Unfortunately, little research has been conducted into the control of invasive sagg and rushes in Tasmanian native pastures.



*Sagg, sedges and rushes commonly occur in poorly drained areas of native pasture.*

## SOWN PERENNIAL GRASSES

Sown perennial grasses include the pasture grasses commonly sown in Tasmania, such as perennial ryegrass and cocksfoot (*Dactylis glomerata*). Attempts to sow pastures in unsuitable areas are unlikely to succeed, and may lead to accelerated erosion or a change in dominance from perennial to annual species. Your property plan should highlight the areas on the property that are not suitable for sowing perennial grasses (see Chapter 3).

Once a pasture has been cultivated or direct drilled with sown grasses, it is no longer considered a native pasture.

Perennial ryegrass is the most common sown grass present as a volunteer species (not deliberately sown) in fertilised but uncultivated native pastures. Sown perennial grasses may compete strongly with native grasses on moist, fertile sites. However, native grasses often outlive sown perennial grasses during drought. Sown pastures are often invaded by native species, particularly if sown in unsuitable areas.

## UNDESIRABLE PERENNIAL GRASSES

Common undesirable perennial grasses include browntop bent, sweet vernal grass, Yorkshire fog, crested dogstail (*Cynosurus cristatus*) and bulbous meadowgrass (*Poa bulbosa*). Undesirable perennial grasses provide poor fodder because livestock find them unpalatable.

Undesirable perennial grasses often invade fertilised native pastures, and can compete strongly with native grasses. However, they are common only on deeper soils in moist situations or higher rainfall areas. Intensive grazing reduces animal selectivity and forces livestock to graze these undesirable introduced species. Providing adequate rest increases the competitive ability of desirable species.



Sown perennial grasses, such as cocksfoot, may occur in native pastures as self sown species in moist, fertile situations.



Perennial grass weeds, such as sweet vernal grass, Yorkshire fog and browntop bent, can invade fertilised native pastures.



### INTRODUCED ANNUAL GRASSES

Annual grasses are grasses that germinate in autumn and die off in spring after flowering and setting seed. Common introduced annual grasses in native pastures include silvery hair-grass, squirrel-tail and rat's-tail fescue, lesser quaking grass, rough dog's tail (*Cynosurus echinatus*) and soft brome. Annual grasses can produce large amounts of seed that germinate after rains in autumn and winter. The emergence of seedlings is greatest on bare soil in the gaps in the perennial grass cover or when perennial grasses are less dominant.

Although common in native pastures, annual grasses are major components of native pasture only when soil fertility has been increased by fertiliser or on stock camps. In these situations, annual grasses can provide useful forage for livestock, and may provide short-term ground cover to resist soil erosion. However, they become unpalatable at maturity in spring, and compete strongly with valuable native grasses.



Annual grasses, such as rat's-tail fescue, can compete strongly with native grasses where soil fertility is high

### INTRODUCED ANNUAL CLOVERS

Annual clovers occur as volunteer species in most lowland native pastures in Tasmania. The common annual clovers are introduced species, and include subterranean clover, cluster clover (*Trifolium glomeratum*), suckling clover (*T. dubium*), knotted clover (*T. striatum*) and hop clover (*T. campestre*). Perennial clovers, such as white clover, do not usually occur in Tasmanian native pastures, because they need more than 700 mm annual rainfall to survive as a perennial plant and cannot withstand summer drought.

Annual clovers form a major component of native pastures only when soil fertility has been increased. In these situations, they can provide valuable winter and early spring forage, and they play a key role in increasing soil fertility by fixing nitrogen.

However, production from annual clovers is highly seasonal and unreliable, being heavily dependent on soil moisture. If not controlled by grazing, annual clovers can become dominant in fertilised native pastures during high rainfall years, causing a decline in the abundance of native grasses (see page 53 'Grazing strategies to reduce abundance of clover in native pasture'). In poor years, pastures dominated by clovers remain bare, exposing the soil to erosion and invasion by undesirable plants.

### INTRODUCED BROADLEAF WEEDS

Introduced broadleaf weeds may be annual or perennial species. Species commonly found in native pastures include flatweeds (*Hypochoeris* spp., *Leontodon taraxacoides*), plantains (*Plantago* spp.), chickweeds (*Cerastium* spp., *Moenchia erecta*), heronsbill (*Erodium* spp.) and thistles (*Cirsium* spp., *Carduus* spp.). Broadleaf weeds generally have low palatability, but some species, such as flatweeds, are quite palatable and nutritious. Most species only become a problem when perennial grasses have been overgrazed or perennial ground cover is reduced. As with many introduced species, this usually occurs following increased soil fertility and inappropriate grazing management.



Thistles, such as slender thistle, can invade sheep camps and other high fertility sites.

## TREES AND SHRUBS

Scattered native trees and a range of native shrubs are a natural component of native pastures. They are valued for their role in providing stock shelter and enhancing biodiversity. However, some graziers consider native species such as eucalypts (*Eucalyptus* spp.), wattles (*Acacia* spp.) and prickly box (*Bursaria spinosa*) to be weeds in some situations.

Native species are more likely to be a problem as woody weeds in overgrazed pastures. Bare ground created by overgrazing can encourage invasion by native trees and shrubs due to reduced competition from the perennial grasses.

Prickly box, in particular, can spread in open areas in native and sown pastures. In the past, hot fires were used to prevent woody species establishing, but in many areas this is no longer a realistic management option because of the danger from wild fires.



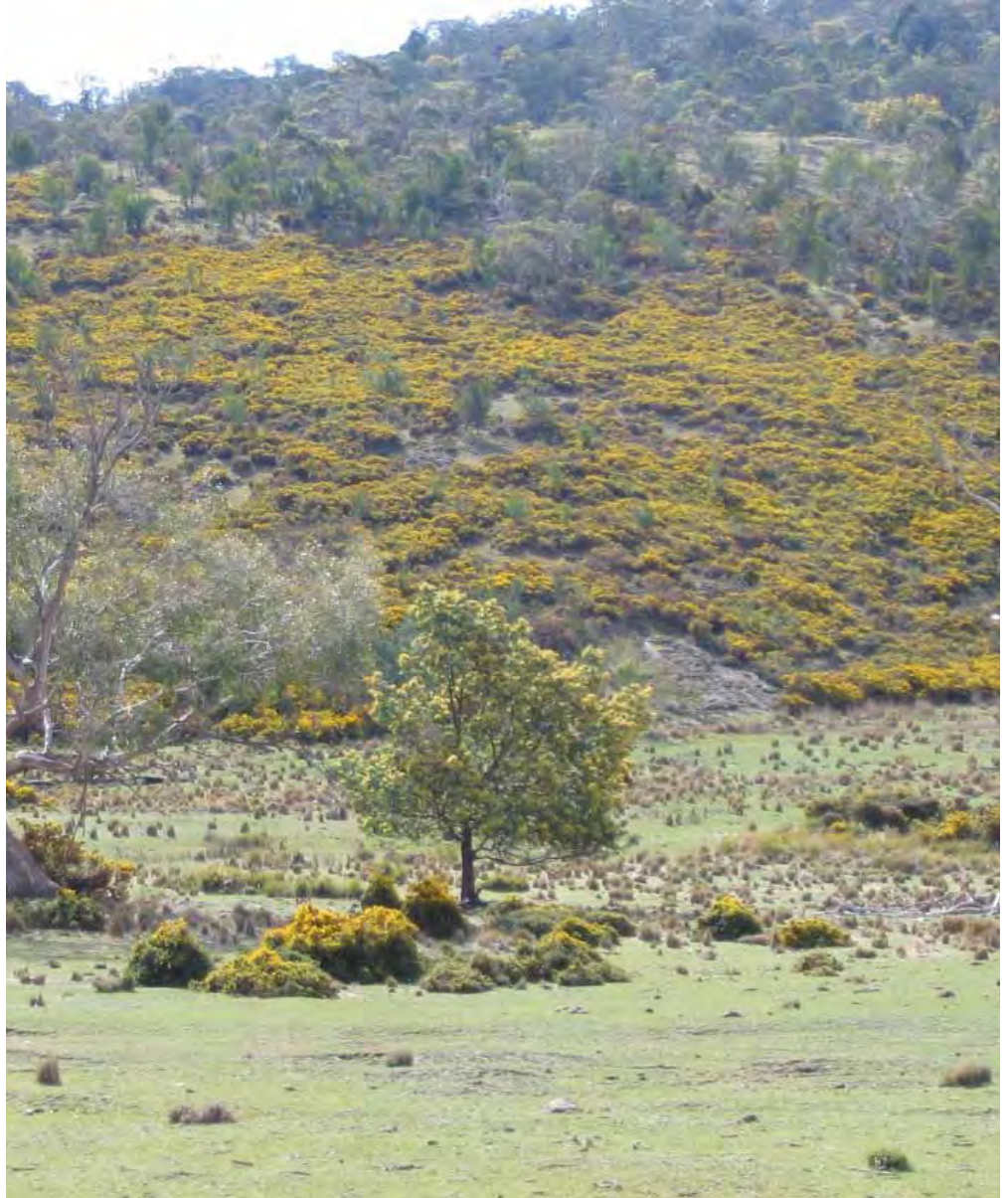
*Prickly box can be invasive in some situations.*



## INTRODUCED SHRUBS

### Gorse

Gorse is an invasive introduced shrub that can grow to a height and diameter of 2–3 m in 5 years. It forms dense infestations in the Midlands, and can reduce productivity by invading large areas of productive pasture. Gorse does not spread vegetatively. However, it does shoot back from the stem and roots if cut back or burnt. Gorse seeds can be thrown about 3 m from the parent plant when the seed pods burst, which occurs frequently in hot dry weather. The seeds can remain dormant in the soil for more than 20 years. They germinate when existing bushes are burnt or removed mechanically, causing a flush of seedlings to appear.



*Gorse can be a major problem in native pastures.*

# 3

## Property Planning and Managing Native Pasture



### KEY POINTS

- » Property planning allows the property's resources to be managed efficiently and sustainably.
- » Native pastures and sown pastures are complementary, and can be managed strategically to maintain pasture condition and livestock health.
- » Locating fences along the boundaries between different land types minimises overgrazing of some areas and undergrazing of others.
- » Subdividing large paddocks and strategically locating watering points can provide greater flexibility for managing grazing and protecting sensitive areas, such as north-facing slopes.



### WHY HAVE A PROPERTY PLAN?

Managing native pastures for production and nature conservation takes place in the context of the 'whole' farm, the management team, and current and predicted markets.

Property planning seeks to improve business profitability while developing sustainable farming practices to protect natural resources. Property plans should not be seen as fixed. Rather, they should develop over time as the natural resources become better understood, goals evolve, and markets and technologies change.

This chapter examines only two aspects of property planning: mapping the location and condition of natural resources, and considering native pasture management in the context of the wider grazing and farm management system.

*“ My property plan is a feasibility study of what's possible on the farm. I would like to return 10–20% of my farm back to native vegetation. The plan is part of an on-going process. ”*

### DEVELOPING A PROPERTY PLAN

Your property plan should state where you are now, where you want to be, and how you intend getting there. Mapping and reviewing the condition and location of the natural resources on your property enables you to understand where you are now.

Before you can make a plan, you need to set down what you hope to achieve. Your goals should incorporate a triple bottom line (social, economic and environmental) approach to planning. Your goals should be written down and agreed upon by all who have a say in the running of the farm. Involving family members and farm staff in the planning process is essential. It provides ideas from a range of people, and enhances everybody's commitment to the changes set out in the plan. Farm plans take time to develop, and evolve with changing attitudes, ideas, farming techniques and opportunities.

### WHERE YOU ARE NOW

Collect all the information available about the natural resources on your property, such as soil maps, land capability maps, hydrology maps, vegetation maps, contour maps and aerial photographs. Many of these resources are available in either paper or computer form (digital data) from Service Tasmania.

Use these resources to compile a multilayered map of the property using clear acetate sheets or digital layers in a geographic information system (GIS) computer software. Use a separate layer for each theme, such as hydrology, and overlay them over an aerial photograph.

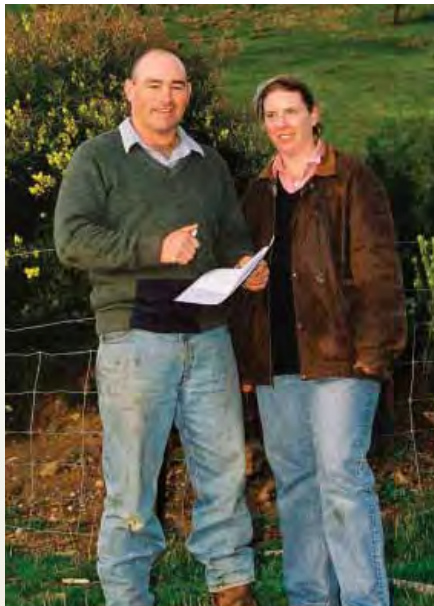
Use your knowledge of the property to add any details to the maps that may be relevant for developing your property plan, such as infrastructure, erosion, salinity or animal habitat. Don't forget to include any potentially relevant information that you have learnt as a result of reading books, brochures, consultants' reports and so on.

The maps will be used for a variety of purposes, including

- » showing the potential productivity of the property
- » showing where production activities could result in land degradation
- » showing conservation priorities
- » showing activities, such as stocking rates, fertiliser application and pasture renovation
- » planning new paddock and infrastructure boundaries.

# Sarah Ackland & Steve Barrington

'Apsley Park', Apsley



'We developed a property plan for Apsley Park largely to ensure that we had a shared vision for improving the property, and to help determine how we were going to go about achieving that vision. The plan enabled us to set down what had to be done, and to prioritise those actions. With a property plan in place you overcome the daunting feeling of wanting everything to be done at once. You feel as though you're working towards an end goal.'

'Mapping the physical resources of the farm highlighted issues that needed to be addressed. Many of the fences on Apsley Park are over 40 years old, and in urgent need of replacing. This gives us the opportunity to realign fences according to slope, aspect, soil type and vegetation cover, all of which are shown on our map.'

'The first priority is to fence off north-facing slopes so they can be managed separately. Some of these slopes are on sandy soils,

which makes them particularly vulnerable to erosion. They are the first to dry off in summer, and it is essential to make sure that you don't overgraze them at this time. However, when you do get rain, they respond a lot quicker than the heavier soils, so you can put sheep on them first after the autumn break, before moving them on to the heavier country.'

'Correctly managing the bush areas on Apsley Park is a major issue. The plan identifies the best areas of bush, and documents the way these areas have been managed. The important thing with these areas is to continue managing them in the same way they have been managed in the past. In some cases, where the plan involves increasing stocking rates on adjacent areas of improved pasture, we need to fence off the bush. However, if the bush is already badly degraded, it will not be a priority to fence it off.'

Grazier viewpoint

Property planning

### Knowing your land capability

Land capability maps indicate the capacity of different parts of the property to support different intensities of agricultural use (Figure 2). Land capability enhances the basic soils information by considering factors such as slope, erosion hazard, climate and the area's potential agricultural versatility.

Some of Tasmania's land capability maps are based on 1:100,000 surveys of private land, while others are based on modelling of the mapped areas. Either way, the scale of the maps is really too small for farm planning, so they should be augmented with surveying of the farm by yourself or a consultant.

Tasmania's Land Capability Classification System (Grose, 1999) comprises seven classes ranked in order of increasing limitation in relation to agricultural use, and decreasing agricultural versatility. The classes are defined as follows:

- » Classes 1 to 3 are considered to be prime agricultural land
- » Class 4 is considered to be marginal cropping land
- » Classes 5 and 6 are considered to be suitable for grazing only
- » Class 7 is considered to be unsuitable for agriculture.

Extensive areas in Tasmania's grazing regions are Class 4 land. The soil in these areas is deep enough to be ploughed and sown to introduced pastures. However, it does not always produce better pastures than Class 5 land, because the soil may be lighter and more drought prone.

Class 5 land is not suitable for broadacre cropping. However, it may have good grazing potential, perhaps having flat to moderately

sloping terrain with few surface rocks. Class 6 land is bush run country, having steeper slopes, rock outcrops, shallow soils and/or a northerly aspect. Pastures on less productive, Class 6 land, tend to decline more rapidly in summer than pastures on more productive, Class 5 land. Pastures on Class 5 land also tend to be more resilient to adverse conditions than pastures on Class 6 land because of their deeper soils and greater moisture retention and fertility.

A land capability map provides a guide for planning new fences. If it makes economic sense, paddock boundaries can be relocated over time so that paddocks have consistent land capability ratings. This makes it easier to manage stocking rates without overgrazing some areas and undergrazing others.

### Knowing your hydrology

Water moves through the landscape over the ground, through the soil, and through groundwater systems. Tasmania's digital hydrology layer and 1:25,000 TASMAR maps show rivers and streams, intermittent watercourses and drainage lines, wet areas, wetlands and floodplains (Figure 3).

The presence and action of water often influences paddock layout. For example, paddock layout may be designed to enable livestock access to water, irrigate crops, or isolate boggy and flood-prone areas. Fencing according to hydrology often makes good sense. For instance, damp areas commonly provide good habitat for liver fluke, so fencing off such areas to prevent stock access reduces the likelihood of fluke infection.

### Modelled land capability



Figure 2. Modelled land capability (red: Class 4, blue: Class 5, purple: Class 6). Existing fences (red line)

### Hydrology and topography



Figure 3. Hydrology and topography (pink: 10m contour lines, blue: streams and drainage lines, blue hatching: wet areas)

### Native vegetation communities

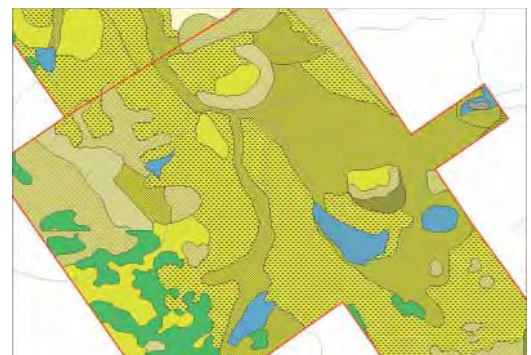


Figure 4. Vegetation communities (yellow: native grassland, blue: wetland, khaki: scrub, green: woodland)



## Knowing your native vegetation

Mapping the native vegetation on your property is a fundamental part of developing a property plan. This may be done from aerial photographs and ground-truthing, or by using TASVEG.

TASVEG Version 1.0 is a State-wide map of Tasmania's vegetation at a scale of 1:25,000 that uses over 150 ecological mapping communities. Vegetation maps can be sourced from Service Tasmania as digital information (Figure 4). Information is also available on other natural values such as threatened species.

It is also important to make an assessment of the condition of the native vegetation. Recording the condition of the vegetation (e.g. presence of dieback, regenerating trees, woody weeds), the variety of groundcover, grass, shrub and tree layers, and the grazing and fire management history will help you

determine which areas of native vegetation should be targeted for specific management actions. Such could include changing grazing management, controlling weeds, and promoting tree and shrub regeneration. The Tasmanian Bushcare Toolkit (Kirkpatrick & Gilfedder 1999) will help with management information.

## MAPPING AND PLANNING FARM INFRASTRUCTURE

### Fencing

Most properties comprise a variety of land types, such as south-facing slopes, eucalypt woodlands and river flats. The location of fences is usually a legacy of past decisions, and is not always related to land type. This can result in uneven grazing intensities in paddocks (e.g. livestock usually graze north-facing slopes more heavily than

other parts of a paddock). If grazing intensity is uneven, strategic fencing allows more even utilisation of the pasture through grazing management. The preferred location for fences is between the boundaries of different land types as defined by topography, aspect and land capability (Figure 5).

Subdividing large paddocks can be a useful tool for managing native pastures. Using fencing to produce several smaller paddocks allows some paddocks to be grazed intensively at key times of the year, such as when the annual grasses are flowering or setting seed, and others to be rested at key times of the year, such as when the native grasses are flowering or setting seed.

Relocating fences in more appropriate locations, reducing paddock sizes and providing better access to water makes more feed available because of better grazing control. Well designed fences and watering points can be expected to last for 40 or more years.

### New paddock subdivision



Figure 5. Paddock subdivision into four new paddocks follows hydrology and land capability (see Figures 2 and 3), separating areas that remain wet from those that are drier. It also seeks to obtain similar feed supply between paddocks and separate grasslands from woodlands for tree regeneration (Figure 4).

“ Before we fenced off the northerly slopes from the flats they were spoiled with stock camps and nutrient transfer, so that horehound and prickly box spread in many areas. Fencing has enabled us to run our best wethers on these slopes. ”

## Chapter 3 Property Planning and Managing Native Pasture

Unfortunately, relocating fences and subdividing larger paddocks is not cheap. The financial returns from native pastures are low, but the capital expenditure can be minimised by using low-cost fencing, such as electric fencing. The cost of strategically locating fences and subdividing larger paddocks must be weighed against the long-term benefits, including increased pasture productivity, increased pasture utilisation and decreased soil erosion.

Fencing has an important role in limiting stock access to sensitive areas, such as

- » pastures needing rehabilitation
- » areas with highly palatable threatened species
- » north-facing slopes where soil erosion is a problem
- » riparian bush and wetlands
- » gullies and areas of thick vegetation that provide important fauna habitat (difficult to muster sheep in these areas)
- » recently burnt bush
- » regenerating bush.

### Watering points

The location of watering points can have a dramatic effect on the intensity of grazing in different parts of a paddock. If livestock have to travel more than 1.2 km to get to water, the land near the watering point will be overgrazed and the land further away will be undergrazed. Locating watering points in the centre of large paddocks can help avoid such problems. Alternatively, watering points can be located strategically in areas of the paddock that would benefit from more intense grazing, and away from areas that are more sensitive or have previously been overgrazed. The cost of relocating watering points needs to be weighed against the long-term benefits, such as better utilisation of pasture and higher productivity.

### RECORDING FARM MANAGEMENT INFORMATION

Paddock layout maps are a wonderful tool for recording your management. They can be used as a yearly record of

- » stocking intensity and patterns
- » DSE ratings
- » fertiliser type and rates
- » pasture monitoring.

*“ Today we’ve got access to good GIS information, so we can accurately map paddock boundaries and calculate paddock areas. We can then rate all our paddocks on carrying capacity, based on what stocking rates we have run in the past and the condition of the pasture. Then we can determine what stocking rate we are going to run in the future. ”*

## BALANCING NATIVE AND SOWN PASTURES

An important point raised by many Tasmanian graziers is that native pastures and sown pastures are complementary. A diversity of landscapes and pasture types on farms provides balance, flexibility and resilience to pests. Sown pastures are usually more productive than native pastures, and provide large amounts of high quality stock feed. However, sown pastures need greater inputs to maintain them in good condition.

Native pastures can play a strategic role in the property grazing system. Tasmanian graziers can run more merino wethers if they have run country. Native pastures can also act as a forage bank when feed is short during drought or winter, which is vital on many grazing properties. Most native pastures are stocked from late summer until lambing and shearing in spring, which provides valuable winter feed (Figure 6).

Native pastures can also be used to run sheep that have been grazed on sown pastures over winter for a short time before shearing in early spring to reduce scouring and consequent damage to the wool.

*“ The native pastures allow us to spread our stock over a wider area over the autumn - winter period, when pasture growth rates are low. If we then shut them up over the spring - summer period, and concentrate our grazing on the improved pastures, this allows us to control the huge flush of growth in the spring and early summer. ”*



Moving stock from native to improved country in spring allows the runs to recover, and ensures that the sown pastures are fully utilised.

### Timing the use of native pastures

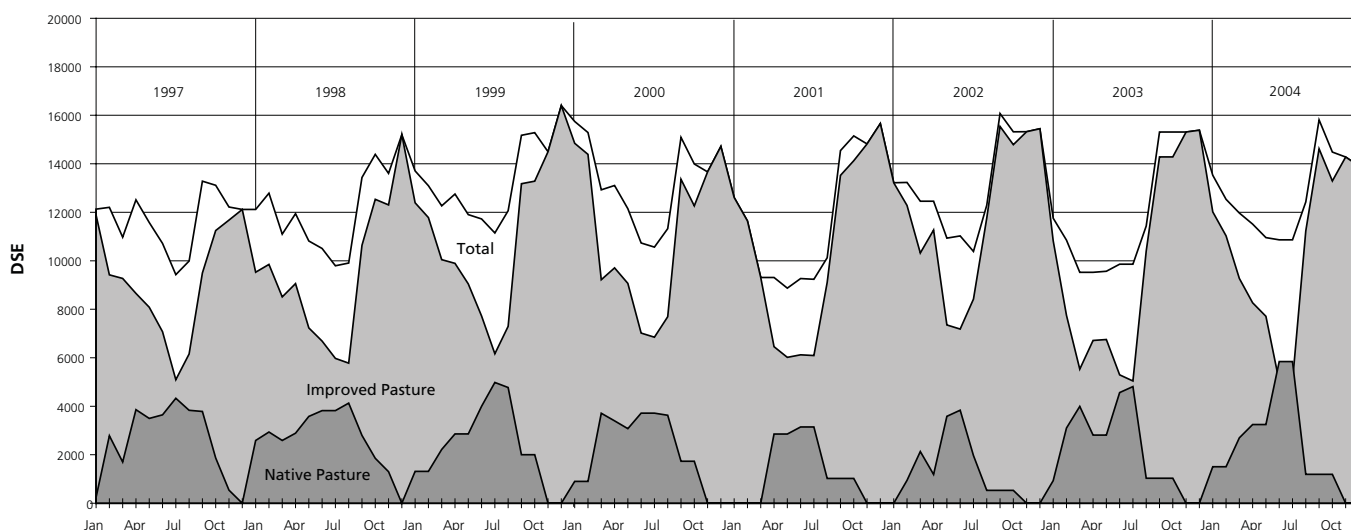


Figure 6. Distribution of sheep grazing between native and improved pastures on a property at Dunalley from 1997 to 2004.





## John Fowler

Bendeveon, Bothwell

'In the 1980s, we started a development program on our Trap Hut property, and fencing was the cheapest and most cost-effective form of development we did. We cleared some areas, and ploughed some areas, but fencing was the best return—by a long shot.

'Before fencing, the stock would just selectively graze the best country, and there was a large proportion of the place they didn't even go near. So, purely by fencing, we were able to have a lot more area available for grazing.

'There was one paddock where we used to run 600 wethers. It has a plateau area in the centre and gorges around it. We fenced around the plateau. In the first year, we ran 1000 wethers just around the edge, and still ran our 600 wethers on the plateau area in the centre.

'The initial fencing we did in the 1980s was all permanent fencing. Then, in the 1990s, we came back through there with electric fencing and subdivided it, and went to rotational grazing to improve our grazing control.

'Fencing enabled us to stop the sheep overgrazing the north-facing slopes, and get them grazing the south-facing slopes. The north-facing slopes were in terrible condition. The plants were on pedestals and most of the topsoil had gone. Now, we've got our ground cover back. There was no kangaroo grass out there, but now it's coming back.

'In our experience, fencing is the most cost effective thing to do. Your dry matter production per year goes up, your utilisation goes up, and the area of the farm you're using goes up. Fencing also extends the time I have green feed. I can use the north-facing slopes in winter, and then move stock to the south-facing slopes in summer when there's still some green feed available.'

# 4

## Managing Grazing on Native Pastures

### KEY POINTS

- » Understanding how grasses respond to grazing is critical for sound grazing management.
- » Grass growth is slow when grasses have been grazed too short.
- » The shorter a pasture is grazed, the longer it will take for the regrowth to reach its potential growth rate.
- » Perennial species usually weaken and die off when grazed continuously.
- » Overgrazing is one of the main causes of degradation of native pastures.
- » Grasses are most productive when the most appropriate stocking rate is used, so match the stocking rate to the pasture's carrying capacity.
- » The most appropriate stocking rate varies from year to year and from season to season.
- » Using the most appropriate stocking rate is more important than choosing a particular grazing method.
- » Pastures should be allowed adequate time to recover after grazing.
- » Pastures should be strategically grazed so that competition and seed production from desirable species is maximised.
- » Maintain at least 70% cover of pasture plants throughout the year.



## GRASS GROWTH AND GRAZING

Understanding how grasses respond to grazing is an important basis for sound grazing management. Grasses have evolved to tolerate grazing. Their growing points are located at the bases of the plants close to the ground so grazing animals cannot bite them off or damage them easily. After grazing, the remaining leaves can continue to grow from growing points in the bases of the leaves, while basal buds in the crown of the plant are stimulated to produce new shoots (tillers) (Figure 7). In contrast, the growing points of broadleaf plants, such as legumes, are located higher up the plant, so they are more likely to be removed by grazing (Figure 7).

When grasses are grazed heavily (too short), regrowth is slow, because only a small area of leaf remains to capture light (Figure 8 – Phase 1). During this period of slow growth, energy reserves from other parts of the plant, such as the roots, are used to help the leaves regrow. As the area of leaf increases, growth becomes more rapid, because a larger leaf area is available to capture light (Figure 8 – Phase 2). During this period of rapid growth, the grasses build up their energy reserves and store them in their roots, which allows them to recover rapidly from future grazing.

### Responses to grazing

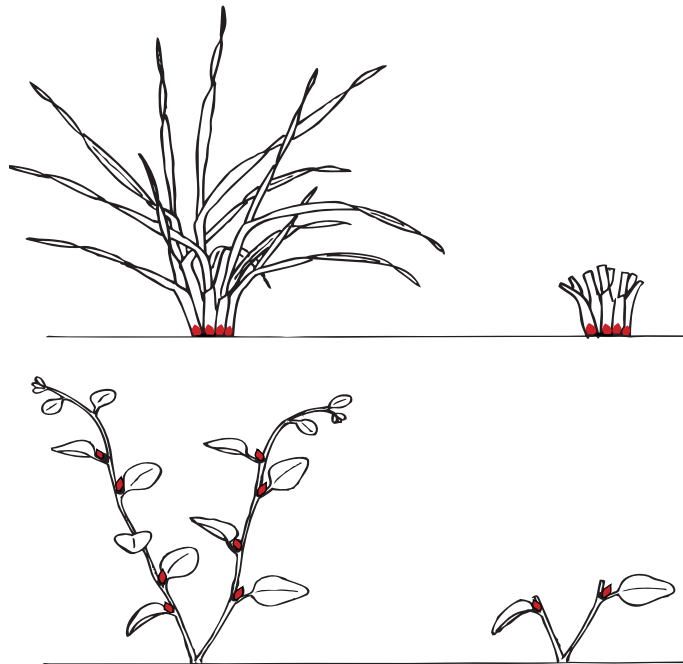


Figure 7. Diagrammatic representation of the responses of grasses (top) and broadleaf plants (bottom) to grazing, showing the position of the growing points (red). Grass leaves keep growing from their bases after grazing, and new tillers arise from the basal buds, while broadleaf plants lose many of their buds during grazing.



Continuous heavy grazing can irreparably damage native pastures.

If grasses are grazed to maintain a relatively large leaf area, the pasture will provide good quality feed and be more productive, and the grasses will recover more rapidly. If grasses are repeatedly overgrazed, the energy reserves in the roots will diminish and the plants will take longer to recover. Native grasses take longer to recover from grazing than sown grasses.

It is best not to graze pastures too heavily, because they will take longer to recover sufficiently to carry livestock again. Continued heavy grazing leads to a loss of energy reserves in grasses, and reduced grass vigour. Older roots are not replaced by new ones, so root systems become smaller, which limits the grass plant's ability to capture soil water and nutrients. Grasses can also be damaged if grazing occurs while the grass is resprouting from its reserves after a period of dormancy, such as after drought or fire.

## RESPONSES OF OTHER NATIVE SPECIES TO GRAZING

Most native species in Tasmanian native pastures tolerate some grazing. Grazing-sensitive species, such as soft peppergrass (*Lepidium hyssopifolium*) and spur velleia (*Velleia paradoxa*), are highly palatable and are not adapted to recovering from grazing. Therefore, they are often listed as threatened species and need ongoing protection from livestock.

Although some native plants are threatened by grazing, many rely on grazing to reduce the dominance of native grasses and create bare spaces where they can establish and thrive. These bare spaces are particularly important for rare native annuals, lilies and orchids.

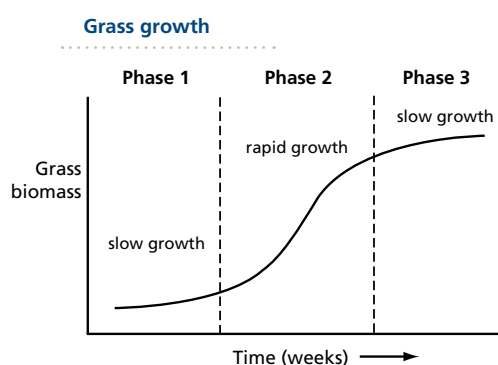


Figure 8. The three phases of growth that occur as grass biomass increases over time.

Maximising pasture growth involves adjusting livestock numbers and grazing periods according to the season. A grazing trial on a kangaroo grass pasture at Nile in Tasmania (Friend *et al.* 1999) found that resting the pasture in spring resulted in a 48% increase in pasture growth compared with continuous grazing (no resting) (Table 4). Increasing livestock numbers in spring decreased pasture growth by 11% compared with continuous grazing at constant livestock numbers.

In the absence of grazing or under continuous light grazing, grasses become rank, the nutrient content of the leaves decreases and the rate of growth again slows (Figure 8 – Phase 3).

Table 4. The effect of resting in spring compared with continuous grazing at a constant stocking rate and continuous grazing with an increased stocking rate in spring on net pasture growth (NPG - the difference between true growth and decay measured as kilograms of dry matter (DM) per hectare per day) of a kangaroo grass pasture at Nile, Tasmania.

Treatment	Mean NPG (kg DM/ha/day) <sup>1</sup>
Spring resting	5.45
Continuous grazing	3.69
Continuous grazing with increased grazing pressure in spring	3.29

<sup>1</sup> Mean net pasture growth rate over 5 years, September 1993–September 1998.



### MANAGING NATIVE PASTURE AS FEED

Healthy, diverse native pastures provide livestock grazing them with all their nutritional needs: energy, protein, fibre, vitamins and minerals. The capacity of a pasture to meet the nutritional needs of livestock depends on the quantity and quality of forage available. The quantity of forage depends on the pasture growth rates, which vary through the year (Figure 9). Forage quality, as measured by digestibility, crude protein and metabolisable energy, also varies through the year (Figure 9).

Forage quality is highest when the pasture plants are young and actively growing during winter and early spring (Figure 9). It declines as the plants mature, flower, set seed, and the leaves dry off in late spring (Figure 9). Ranges in forage quality measures for kangaroo grass and wallaby grass pastures in Tasmania are shown in Table 5.

High quality feed is digested rapidly by livestock, providing high levels of energy and releasing nutrients. It passes through the animal quickly, which allows the animal to keep eating and producing (growing or lactating). Low quality forage takes a long time to digest, and a large proportion is excreted and not used. It passes through the animal slowly, which restricts the animal's intake and results in lower animal productivity. Dry standing feed may initially provide the maintenance requirements of dry livestock, but it gradually declines in quality due to leaching of the nutrients by rain.

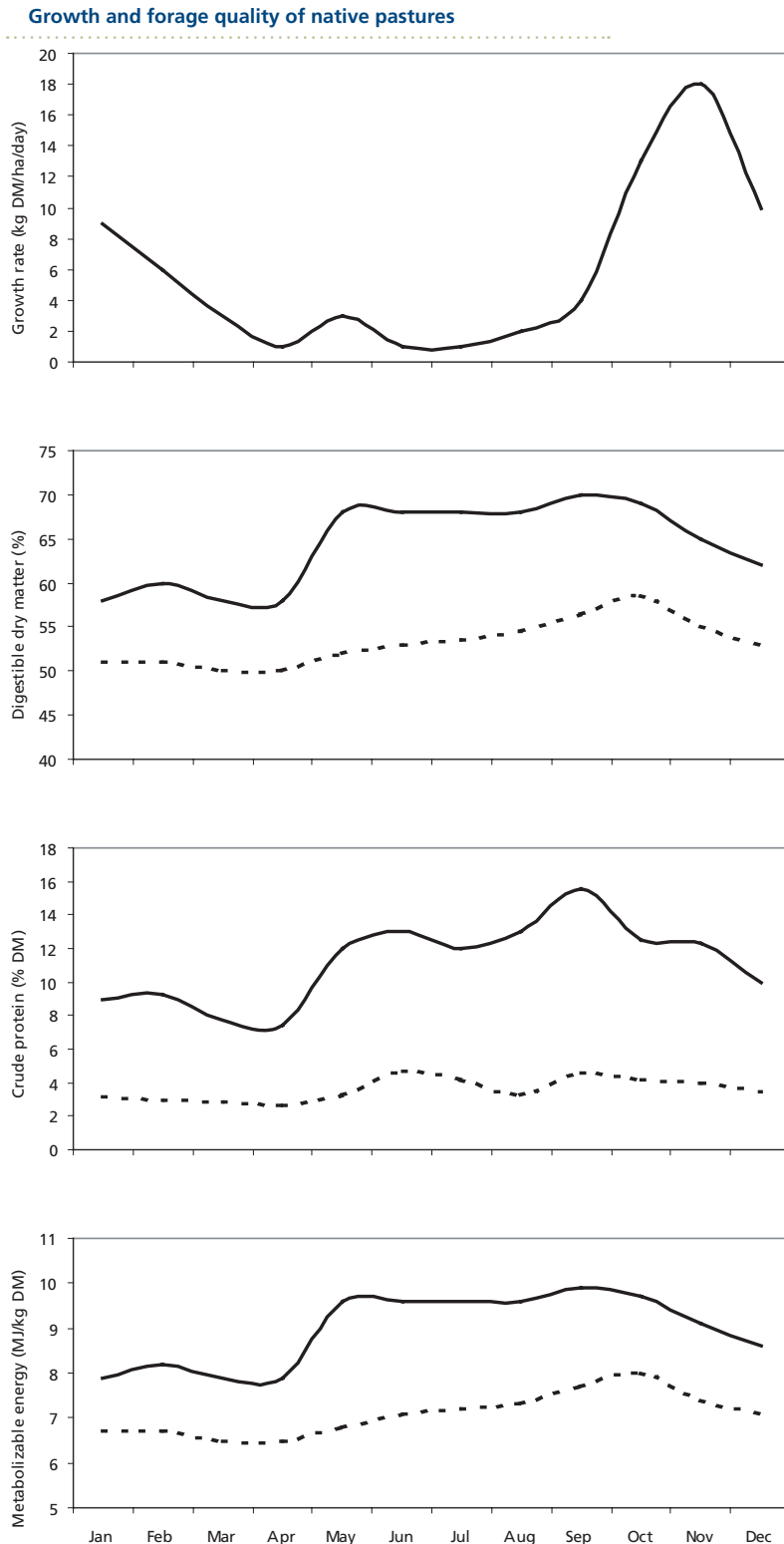


Figure 9. Seasonal changes in pasture growth rate and seasonal changes in forage quality as measured by digestible dry matter, crude protein and metabolisable energy for green herbage (solid lines) and dead herbage (broken lines) in a kangaroo grass pasture, based on data from Nile, Tasmania, for the period September 1993–September 1998 (DM = dry matter).



Green actively growing native pastures (top) provide high quality forage for livestock. When foliage dies off in summer (bottom), forage quality rapidly declines.

Feed supplementation blocks ('lick blocks') containing nitrogen (urea), phosphorus and sulphur can help livestock utilise dry or rank feed, and can eliminate the need to burn rank fodder. These supplements help maintain the condition of sheep grazed on dry, rank pastures, and may improve the quality of wool produced. However, despite the benefits, many graziers are not sure if their use is justified economically. In addition, these supplements may encourage overgrazing and damage to tussocks, and may lead to the loss of shrub species through increased grazing pressure.

The nutritional requirements of sheep and cattle vary throughout the year and are influenced by the reproductive state, age and condition of the animal. Successful grazing management requires a knowledge of the nutritional needs of livestock throughout the year and the capacity of the forage to meet those needs.

*“ Use urea blocks when the pasture is dry. You can tell from the dung—if the vegetation isn't broken down you need blocks. ”*

The consistency of forage quality in native pastures compared with sown pastures makes them ideal for fine wool production. Graziers with an abundance of run country can use this land for wool production from mature wethers, because they need only a maintenance feed intake and are experienced at searching for forage. Wool production from wethers is usually the most economically viable and environmentally sustainable use of run country.

Young growing livestock, ewes in late pregnancy and lactating ewes have more demanding nutritional needs, so they are better suited to lush green pastures with a high energy and protein content (normally sown pastures). In general, it is more difficult to manage native pastures being grazed by breeding animals, because it is not possible to force them onto poorer quality feed.

Sheep and cattle are selective grazers, but they prefer different plants, so they have different effects on the species composition of native pastures. Sheep graze closer to the ground, and tend to concentrate on patches of preferred species, so they have a greater impact on pasture composition than cattle. Cattle are effective in removing tall, rank and dry feed.

Table 5. Ranges in forage quality measures for kangaroo grass and wallaby grass pastures (green leaf) in Tasmania (DM = dry matter).

Digestibility (% DM)		Crude protein (% DM)		Metabolisable energy (MJ/kg DM)	
Autumn	Spring	Autumn	Spring	Autumn	Spring
55–62	66–74	8–12	13–18	7–8	9–11



## Frank O'Connor

'Benham', Avoca

'The majority of our native pastures are on northerly slopes, from 200 to 500 m. They are used purely for wether grazing; we don't run ewes on native pasture. The aim of grazing on this country is to grow high value wool. If you're not growing premium quality wool, you're not making the best use of this country.

'To grow high value wool you need to look after the pasture as well as the sheep. We try to delay putting the wethers back on the runs for as long as we can after shearing in October. Ideally, we would like to see the runs seed before we put the sheep back on them.

'Getting the stocking rate right on native pastures is really important. If you overstock you do an enormous amount of damage. They also seem to perform better if they're not too understocked. We use rotational grazing, and it's just a matter of assessing the pasture to determine when to move the sheep. We run big mobs and rotate the sheep over four or

five runs. With big mobs you have shorter grazing periods and longer recovery periods, which reduces the number of sheep tracks and the amount of bare ground in the pastures.

'We try to have as little bare ground as possible in order to keep the wool free of dust. Maintaining cover is good for the pasture, but it's also sensible for the sheep.

'It's important to make sure that stock have a reasonably even nutrition through the year to avoid tender wool. If feed gets tight in winter, we take the sheep off the runs for a short period. We have some areas that are semi-native, and can put them on this better quality feed in the winter without causing a break in the wool. You certainly wouldn't want to put them on a lush clover pasture. This management gives us the opportunity to spell the runs in winter.



## GRAZING METHODS

The different approaches to stock grazing are described by different terms, including 'rotational grazing', 'rotational resting', 'block grazing', 'cell grazing', 'time-controlled grazing', 'strip grazing', 'mob stocking', 'crash grazing', 'continuous grazing' and 'set stocking'. The different terms suggest that each method is different, but, in reality, graziers usually apply aspects of several methods when managing grazing on their native pastures. Grazing management depends on the grazer's goals and pasture types, and in many native pastures the choices are limited. For example, it is difficult and time consuming to move sheep through thickly wooded vegetation, so rotational grazing may not be practical in bush runs.

The most important thing to consider when adopting a particular grazing method is whether it meets your grazing goals and objectives. Other things to consider include

- » is it based on the biology of the pasture and livestock?
- » is it flexible enough to allow for changing conditions between seasons and between years?
- » does it encourage desirable pasture species?
- » does it meet the nutritional needs of the animals?
- » does it make optimal use of the available moisture?
- » does it maintain native biodiversity and prevent land degradation such as erosion?

The key aspects of grazing management are

- » matching the stocking rate to the carrying capacity (taking into account any grazing from wild herbivore populations)
- » grazing duration (how long livestock are on the pasture)
- » rest period (how long the pasture is rested before being grazed again)
- » timing of grazing with respect to season and pasture condition.

Basically, there are two broad approaches to grazing management: continuous grazing or set stocking, and rotational grazing (Figure 10). These methods and their possible effects on the condition of native pastures are described overleaf.

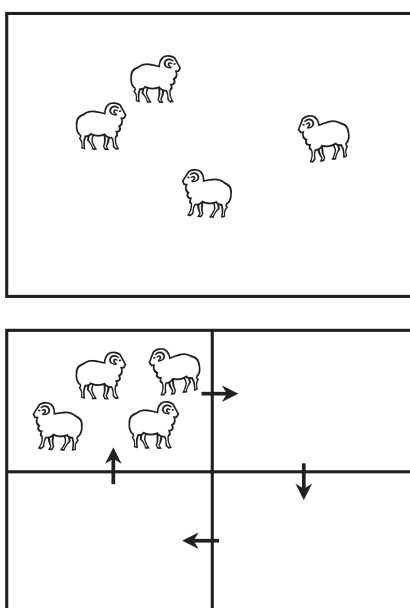


Figure 10. A diagrammatic representation of two contrasting methods of grazing management: continuous grazing (above) and rotational grazing (below). In each case, the stocking rate over the whole area is the same.

It can be difficult to move sheep through thickly wooded vegetation, so rotational grazing may not be practical in bush runs.



## Chapter 4 Managing Grazing on Native Pastures

### Continuous grazing (or set stocking)

Continuous grazing involves grazing a paddock or bush run continuously for long periods of time with a fixed or variable number of animals. Normally, the number of stock varies over time, and stock are usually removed from the paddock for part of the year (i.e. the pasture is rested). Continuous grazing is common on larger runs where moving livestock regularly is impractical.

The main disadvantage of continuous grazing is that it allows livestock to preferentially graze the pasture. This means the most palatable, nutritious and actively growing species are grazed more intensively than the less palatable or dormant species (e.g. many weeds). This can adversely affect the growth of desirable plants, and favour the growth of less desirable plants.

The negative effects of continuous grazing may be reduced if the pasture is rested at key times of the year to benefit desirable species (e.g. resting in spring or summer to benefit kangaroo grass and native wildflowers). Not using high stocking rates will also help limit the creation of bare ground.

A 5-year study compared the effects of different grazing practices on the species composition of a kangaroo grass pasture at Nile in the Northern Midlands of Tasmania (Garden *et al.* 2000). Resting during spring led to a marked increase in kangaroo grass compared with year-round continuous grazing (Figure 11).

Increased grazing intensity during spring led to wallaby grasses becoming dominant due to their ability to avoid heavy defoliation by developing a prostrate growth habit, so they were favoured compared with the more erect kangaroo grass. Flat weeds also increased under increased spring grazing due to the plants ('rosettes') becoming more prostrate, and so avoiding heavy defoliation, and probably also through reduced competition from taller growing species. Sweet vernal grass, a weedy introduced grass, decreased under both spring resting and increased spring grazing compared with year-round continuous grazing. Under spring resting, this may have been due to the increased competitiveness of kangaroo grass relative to sweet vernal grass. Under increased spring grazing, livestock would have been forced to graze this relatively unpalatable grass, reducing its vigour and seed production.

Continuous grazing can have positive and negative effects on the condition and biodiversity of native pastures, depending on the intensity and duration of grazing. Native species such as kangaroo grass and legumes (pea relatives) can be eliminated from continuously grazed pastures due to selective grazing. Some of the more diverse native pastures are continuously grazed at low stocking rates (e.g. 1–2 DSE/ha) and rested in late spring–early summer so native plants can flower and set seed. While desirable species such as clover glycine may be selectively grazed, resting allows them to reproduce.

*“It's not relevant to think of different grazing systems on native country—everyone does a mix of all of them. It's better to look at the principles.”*

### Effect of grazing method on sward composition

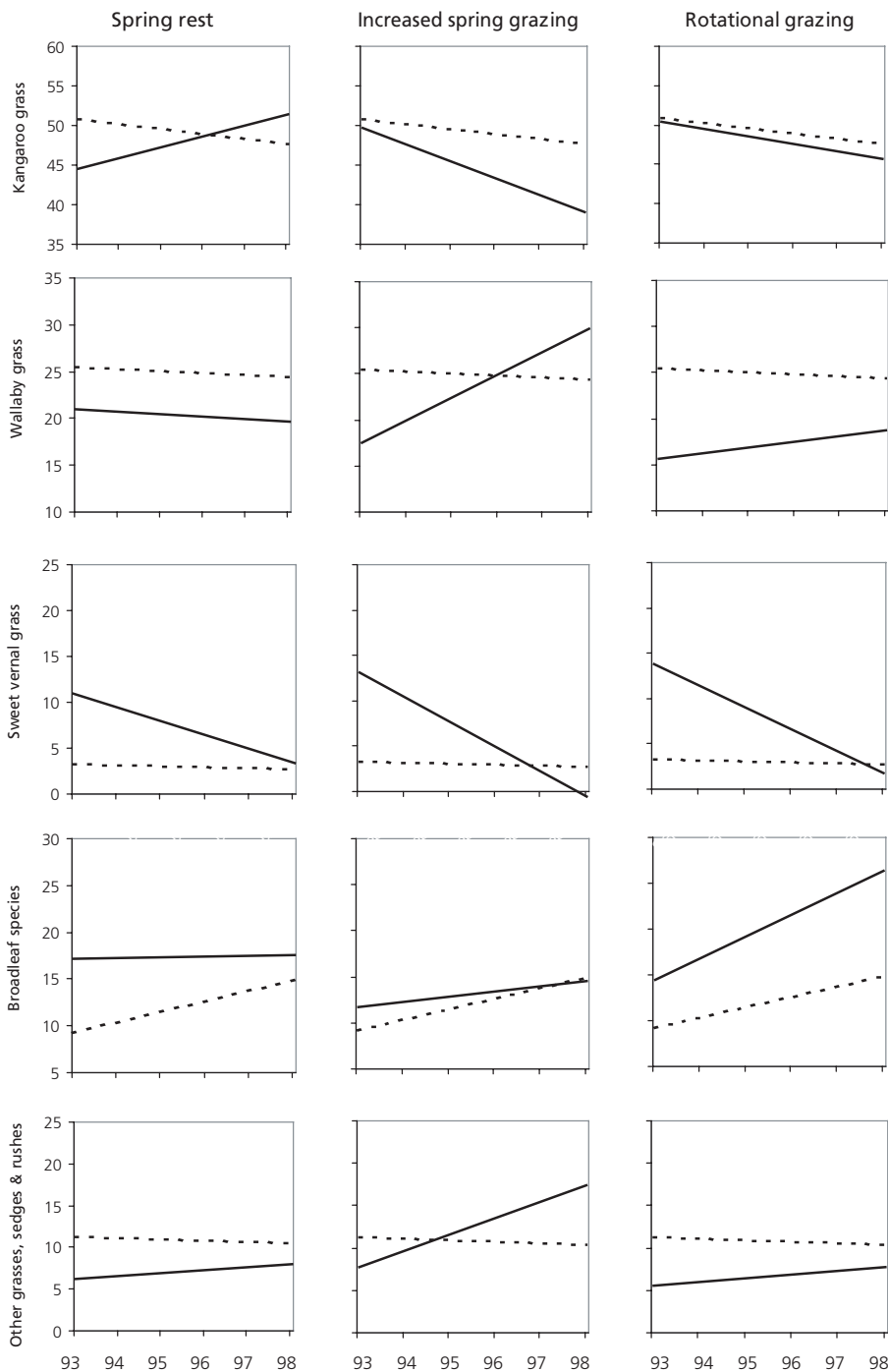


Figure 11. Linear trends in the percentage composition of key species and species groups under three grazing treatments, spring rest, increased spring grazing and rotational grazing (solid line), compared with continuous grazing (broken line), from a 5-year trial (1993 - 1998) in a kangaroo grass pasture at Nile, Tasmania.

Continuous grazing at very low stocking rates may also result in the loss of some native herbs because of the rank grasses shading out the smaller species. Very low or very high stocking rates are also likely to result in woody plants establishing.

### Rotational grazing (including time-controlled grazing)

Rotational grazing involves regular periods of grazing and resting. Livestock is moved from paddock to paddock (Figure 10) after set or varying lengths of time, depending on the season and condition of the pasture. Rotationally grazed paddocks usually carry more livestock during the grazing periods than continuously grazed paddocks (Figure 10), which encourages more even grazing of the paddocks and uses more of the pasture resource.

Time-controlled grazing methods, such as cell grazing, are essentially rotational grazing with a short grazing period, high stocking rate and a large number of paddocks. Thorough time-controlled grazing involves constantly adjusting the grazing interval and stocking rate to the growth rate of the pasture, which varies with season and rainfall. Hence, the stocking rate is flexible and adjusted to match the pasture's carrying capacity.



## Richard Bennett

'Ashby', Ross

'We run 8000 sheep and 250 cows and calves. We use rotational grazing, running the stock in large mobs that we move around. Our aim is to spell the paddocks for as long as possible.

'In the past, the stock were run in smaller mobs, which were rotated more often, so the paddocks were not spelled for such a long time. Time in the paddock is feed-based, it depends on what's there, and we move the stock according to the amount of feed that's there.

'We try to get the stock to eat everything to a certain level, not just selectively eat the clover. There are no set rules as to when we move them, just experience and the appearance of the pasture. You can't set and forget — you need to make sure there's enough feed. Also, we don't want the paddocks to get too dusty, because the wool quality decreases.

Cell grazing is the best known time-controlled grazing method, but other methods include block grazing and strip grazing. Experience from Tasmanian graziers suggests that the minimum recovery period for native pastures under cell grazing is about 90 days, although shorter rest periods may be desirable at times of high pasture growth or when strategically desired. Cell grazing methods on native pastures often need to be modified because of specific problems such as access to water.



*Rotational grazing methods, such as cell grazing, generally involve short periods of high density grazing.*

“ On the first day, the sheep eat the ice-cream; the second day, the brussell sprouts.”

The main benefit of rotational grazing is less selective grazing of desirable species compared with continuous grazing. The reduced selective grazing is a function of livestock density not grazing period, unless livestock are left on the pasture for too long. Under rotational grazing, livestock tend to graze pastures more evenly, which helps control the growth of the less palatable and weedy species, thus giving the desirable species the opportunity to compete more effectively.

Regular resting gives pastures the opportunity to recover from grazing. Allowing adequate recovery time for the desirable species is essential to derive the benefits of rotational grazing. Short grazing and long rest periods may also reduce the effects of stock camps, reduce sheep tracks, and allow better root development.

Heavy stocking for short periods after native grasses have set seed may help break up the soil surface and promote seed germination, and trample and recycle the rank grass. Finally, rotational grazing allows feed to be rationed, and forage to be built up for times of feed shortage, such as late winter.

The advocates of intensive rotational grazing, including some researchers and consultants, claim that it allows more livestock to be carried because it utilises the pasture more evenly. They also suggest that rotational grazing can improve nutrient cycling and the botanical composition of pasture. However, all grazing should be planned according to the seasonal conditions and livestock requirements if the benefits are to be realised and sustained long-term. The possible benefits include greater biodiversity, increased persistence, increased ground cover, more efficient water use, more soil organic matter and higher soil fertility, and better animal productivity.

Few studies have examined the effects of rotational grazing on native pasture condition and productivity. One study in the Northern Tablelands of New South Wales (Earl and Jones 1996) compared continuous and cell grazing, and found that cell grazing increased the vigour and abundance of desirable grasses, such as lovegrass (*Eragrostis leptostachya*), and decreased the vigour and abundance of undesirable grasses, such as wiregrass (*Aristida ramosa*). A Tasmanian trial (Garden *et al.* 2000) that compared continuous and rotational grazing also found a marked decrease in the weedy perennial, sweet vernal grass, with rotational grazing (Figure 11), but there was little effect on the main native grasses. In both studies, the rotational grazing involved a short duration of grazing (less than 4 days) at a high stocking rate (greater than 200 DSE/ha) four times a year. The number of livestock carried (DSE days/ha/year) was similar in both studies.



## Chapter 4 Managing Grazing on Native Pastures



*Rotational grazing with high stock densities reduces selective grazing and increases pasture utilisation.*

Perhaps the greatest benefit of rotational grazing is that it encourages graziers to look at the condition of their pastures as well as the condition of their livestock when planning their grazing management. If livestock movements and stocking rates are not carefully planned, rotational grazing can have adverse effects on the condition of native pastures. Rotational grazing methods may also degrade pasture condition if the timing of grazing and resting is not flexible (e.g. does not allow native grasses to flower and set seed). The New South Wales study (Earl and Jones 1996) showed that native *Poa* tussocks were adversely affected by cell grazing. In addition, the increased subdivision associated with the more intense rotational grazing methods forces stock to graze areas that have previously been ungrazed or only lightly grazed, such as south-facing slopes. Increased grazing intensity in these areas may have negative effects on biodiversity. Excluding some cells from the intensive rotational

grazing regime may reduce these potential effects on biodiversity.

Knowing how different species respond to grazing is useful for managing grazing and manipulating pastures. Information on the responses of different species to grazing, such as that shown in Figure 11, allows graziers to make more informed decisions about when and how to graze, depending on their goals for the pasture. For example, if the grazier wants to decrease the abundance of sweet vernal grass, they could do so by increasing the grazing intensity in spring. However, if they also want to maintain the kangaroo grass cover, the best option would be to use rotational grazing, because it has less impact on kangaroo grass than increased spring grazing.

The success of any grazing method depends on the grazier's ability to monitor their pastures and livestock, and to adapt their management in response to early warning signs (see Chapter 12).

“ You need at least 90 days rest in hard times. We had to give the paddocks 120 days rest last winter as it was so dry. In good times you can speed it up. For stock health you have to move them regularly ... the length of spell is for the paddock but a short graze period is for the sheep. ”

## WHEN TO GRAZE AND REST NATIVE PASTURES

Informed grazing management is based on a knowledge of how the different pasture species respond to grazing at different times of the year. The idea behind managing pasture composition is that you rest the pasture when the desirable species are most sensitive to grazing, and graze it when the undesirable species are most sensitive to grazing. For example, you might rest the pasture when the native grasses are flowering and setting seed, and graze it when the seed heads of the annual grasses are emerging.

### Year-round management of wallaby grass pastures

- » Before the autumn break – Graze to remove any dead plant material. Maintain the ground cover if annual grasses and broad-leaf weeds are a problem.
- » After the autumn break – Rotationally graze to protect establishing native grass seedlings, and allow established native grasses to develop new leaves. Do not graze heavily.
- » Winter – Stock at a low to moderate stocking rate. To increase the density of plants, defer grazing to encourage and protect the native grass seedlings.
- » Early spring – Maintain a low to moderate grazing intensity. To control annual grasses, broadleaf weeds and excess clover growth, use short-term, high intensity grazing.
- » Late spring – To increase the seed set of native grasses, reduce the stocking rate or defer grazing when the native grass seed heads emerge.



*Rest kangaroo grass pastures in mid spring to early summer to allow the kangaroo grass and native wildflowers to flower and set seed.*

- » Summer – Continue a low to moderate grazing intensity or defer grazing until the native grasses have set seed.

### Year-round management of kangaroo grass pastures

- » Autumn – Use high intensity grazing to remove rank growth and encourage the growth of winter-growing native grasses.
- » Winter to early spring – Graze with a low to moderate stocking rate to utilise winter-growing pasture species because kangaroo grass is dormant at this time.
- » Mid spring to early summer – To maintain kangaroo grass, rest to allow kangaroo grass and native wildflowers to flower and set seed. To reduce the dominance of kangaroo grass, graze using a moderate grazing intensity.
- » Mid to late summer – Use a moderate grazing intensity to utilise dry feed and the summer growth of kangaroo grass.

“ Native pastures are crucial to continued superfine wool production on our property because the nutritional value of the feed they provide for our saxon merinos doesn’t vary greatly through the year. ”





*Intensively graze wallaby grass pastures for short periods in early spring to control annual grasses, broadleaf weeds and excess clover growth.*



*Use cattle to graze rank, dry forage.*

## MANAGING GRAZING BY WILDLIFE

Wildlife grazing can reduce pasture productivity and the effectiveness of resting if wildlife move into the paddock when livestock have been removed.

A Tasmanian study (Statham 2000) found that wallaby grazing reduced the availability of forage for sheep by an average of 37%. In most cases, the wild grazers with the greatest impact on Tasmanian native pastures are rabbits, wallabies and possums. However, other animals, such as fallow deer and forester kangaroos, may also pose problems. Effective wildlife management is essential if pastures are to be rested adequately. Before deciding on management actions, it is important to identify which animals are causing the most damage and to assess the extent of lost productivity. This allows the most cost-effective control measures to be determined.

*“ Sheep won’t eat the tussocks and other rank feed, but cattle will. If you want to utilise this feed you’ve got to use cattle to eat it down first. Once you get some green leaf coming, then sheep will eat it. ”*



Many Tasmanian farmers graze large areas of run country that provide habitat for native animals, including threatened species. However, wild herbivore populations, particularly deer and wallaby, in these areas may be greatly increased if wildlife have access to sown pastures. Many graziers try to control wildlife populations through game management plans and control permits from the relevant state department. Shooting and poisoning wildlife are some of the cheapest control measures. They can be useful for controlling populations when numbers increase, but experience has shown that they only reduce wildlife numbers temporarily.

Fencing is a longer-term wildlife control measure that can be highly effective despite the initial costs. The type of fencing needed depends on which wildlife species pose the greatest problem. For general wildlife control, rabbit netting is still the best and most effective type of fencing, although it is also the most expensive. Wallaby fencing has also been shown to be effective, with the initial investment making returns in 5–10 years. Electric fencing may also be useful, although species such as wallabies will test electric fences continually, and push through as soon as the charge drops. Whatever form of fencing is used, most animals will try to get under or through the lower part of the fence, so they should be made impenetrable and checked regularly.



*A combination of wire netting and electric fencing is an expensive but viable option to contain wild herbivores, such as deer and kangaroos.*

*“ Effective wildlife management is essential if pastures are to be rested adequately. ”*



*Grazing enclosures have shown that wild herbivores remove up to 45% of the available biomass in native pastures.*



## Julian von Bibra

'Beaufront', Ross

'There are more wildlife now due to improved pastures. We have a game management plan, and we've tried different forms of game control.

'Fences don't work, they're too much of a maintenance problem, and we haven't had 1080 on the property for over 30 years.

'One deer has a greater impact than one sheep for the same amount of country grazed. Why are deer treated any different to rabbits? In the 1950s, you had a job to find a deer on this place. I want to reafforest large areas of the farm, and the deer destroy the saplings. Over three years of hunting, we've attained reasonable levels.

'Foresters are the touchy-feely Australian emblem. In the long term, I think society won't allow us to shoot them. They do damage fences, but they're easy to control. Wallabies are a big issue for us, and we have thousands of them. They're harder to control than foresters and they damage the fences.

'Possums do enormous damage to trees, and wombats are a potential erosion problem. Wombats weren't here 20-30 years ago, but now we have them in plague proportions.

'We need to manage all animals. We'd go out of business without game management.'

# 5

## Managing Fertiliser on Native Pastures



### KEY POINTS

- » A property plan can help identify the paddocks that are suitable for fertiliser application.
- » Fertilising can increase the productivity of native pastures, but stocking rates must be increased correspondingly to make it cost-effective.
- » Fertilising can lead to native pastures becoming dominated by clover, which can lead to a loss of native grasses.
- » Careful grazing management is needed to ensure that the cover of native grasses is maintained, and that pastures don't become degraded and weedy after fertiliser application.
- » Fertilising decreases the biodiversity of native pastures with high native biodiversity.
- » Fertilising sown pastures is likely to be more cost-effective than fertilising native pastures.



### WHICH NATIVE PASTURES SHOULD I FERTILISE?

You may want to add fertiliser (normally superphosphate) to your native pastures in an attempt to increase the land's carrying capacity. However, before fertilising, use your property plan to identify which parts of the property are suitable for fertiliser application and which are not. When fertiliser is added to inappropriate sites, such as light soils, introduced annual grasses may replace the perennial grasses and there may be an impact on native species biodiversity.

Once fertiliser has been added to a native pasture, the vegetation will change. Careful grazing management is essential to ensure that deleterious changes do not result in a loss of native grass cover.

### How does fertiliser affect the condition of native pastures?

The most obvious effect of phosphorus fertiliser on the composition of native pastures is an increase in clover content (Figure 12). The effect of fertiliser on the abundance of native grasses depends on the rainfall, grazing management and grass species present. A Tasmanian study (Friend *et al.* 2001a) found that superphosphate produced no obvious effects on the persistence of native grasses, such as wallaby grasses, weeping grass and speargrasses. Indeed, higher soil fertility may be favourable to wallaby grasses and weeping grass, by promoting more vigorous growth. However, native grasses can be negatively affected if clovers become dominant. A survey of Tasmanian native pastures in 1992–93 (Friend *et al.* 1997b) found that wallaby grasses and kangaroo grass were less abundant in pastures that received large amounts of superphosphate.

Many native wildflowers decrease in abundance in response to increased soil fertility, and may eventually disappear from fertilised pastures. Introduced grasses and weeds are encouraged by increased soil fertility, and the negative effect of fertiliser on many native species is due to increased competition from these introduced species. However, in the case of native orchids, fertiliser kills an essential micro-organism in the root system. Fertiliser may also increase the rate of tree dieback by increasing the nitrogen content of leaves, which attracts invertebrates and possums.

Careful grazing management of fertilised native pasture is crucial. Fertilising requires changes in grazing management and monitoring of the pasture to determine whether the abundance of native grasses such as wallaby grasses and weeping grass is being maintained, or whether the pasture is becoming weedy and degraded. Higher stocking rates are necessary to make use of the extra feed, and can help prevent clovers and weedy species becoming dominant. However, stocking rates need to be flexible to avoid overgrazing. In particular, stocking rates should be reduced during drought and as soon as good spring growing conditions end, otherwise grazing pressure on the native grasses can be excessive.

Pasture composition changes with fertiliser

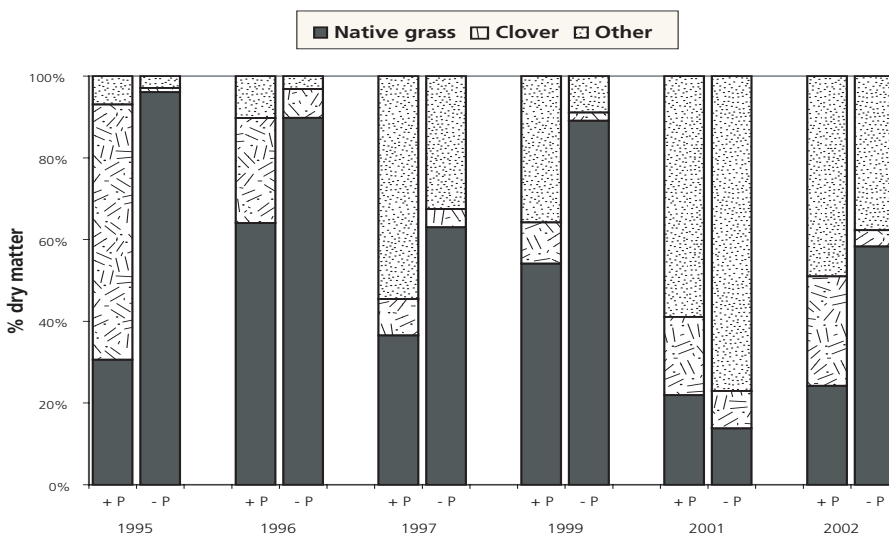


Figure 12. Bar graphs comparing the pasture composition in spring of a fertilised paddock (+P) and an unfertilised paddock (-P), from a paired-paddock trial in a wallaby grass pasture at Bothwell, Tasmania.

## MANAGING CLOVERS IN NATIVE PASTURES

The abundance of clover in native pastures is affected by the amount and distribution of rainfall, the type, amount and frequency of fertiliser application, and the intensity and frequency of grazing. In fertilised native pastures, usually wallaby grass pastures, many researchers suggest that restricting clover abundance to about 20–30% of ground cover or 20–30% of herbage mass is optimal. This level of clover abundance improves the productivity of the pasture without negatively affecting the abundance of native grasses such as wallaby grasses and weeping grass.

To avoid clover dominance, apply phosphorus fertiliser at low rates (eg single superphosphate at 65–125 kg/ha) and increase soil fertility over a long period of time (e.g. 10 years). Maintaining soil phosphorus levels at or below 25 mg/kg (Colwell test) will also limit the clover content of fertilised native pastures.

Grazing management is essential in fertilised native pastures to manage clover abundance and ensure the persistence of native grasses. However, remember that promoting or impeding one species will affect another species. Therefore, before adopting a particular strategy, graziers should consider all possible impacts and outcomes.

### Grazing strategies to reduce abundance of clover in native pastures

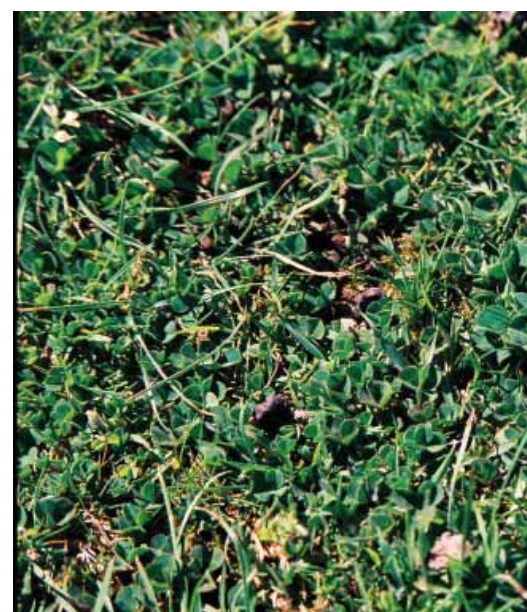
- » Autumn – Graze lightly or rest after the autumn break to maintain good ground cover and restrict the germination and establishment of clover.
- » Winter – Use moderate or short-term high intensity grazing to control clover growth.
- » Spring – Graze heavily during flowering to prevent clover setting seed.
- » Summer – Rest or graze lightly to allow native grasses to increase in vigour and set seed.

### Grazing strategies to increase abundance of clover in native pastures

- » Autumn – Graze heavily to remove dead plant material and control grass growth before the autumn break.
- » Winter – Rest or graze lightly after the autumn break to allow clover seedlings to establish.
- » Spring – Rest or graze lightly to allow clover to flower and set seed.
- » Summer – Graze at moderate intensity to utilise dry feed and new summer growth.



*This fenceline between a fertilised (right) and unfertilised (left) native pasture shows that fertiliser can improve productivity, but fertilised pastures need careful management.*



*Clovers can become dominant in fertilised native pastures without correct grazing management.*

## Chapter 5 Managing Fertiliser on Native Pastures

### IS FERTILISING NATIVE PASTURE COST-EFFECTIVE?

Until the 1970s, superphosphate was applied widely on Tasmanian native pastures. However, fertilising has become less common since then as fertiliser costs have increased and wool prices have decreased in real value (i.e. in relation to the purchasing power of the dollar).

The cost effectiveness of fertilising Tasmanian native pasture was investigated in a study conducted from 1994 to 2000. The study compared adjacent fertilised and unfertilised native pastures at three sites at Nile, Pawtella and Bothwell (Friend *et al.* 2001a,b). Single superphosphate was applied at 250 kg/ha in the first year, and

subsequently at 125 kg/ha every third year. Subterranean clover was sown with the first application of superphosphate. Molybdenum, as sodium molybdate, was also applied at 150 g/ha. The study found that, on average, annual production from native pastures more than doubled following the application of superphosphate. However, the increased annual production varied widely from year to year and between sites, ranging from 0–410% (Table 6). The differences between sites and years were associated with variations in seasonal rainfall. Averaged over the study period, stocking rates increased by more than 100% at Nile, approximately 80% at Pawtella, and 40% at Bothwell (Table 6).

“ Native pastures are not worth fertilising. They go backwards with fertiliser, and have more weeds. It’s better to concentrate the use of fertiliser on improved paddocks. ”

Table 6. The effect of applying superphosphate on (a) annual pasture production and (b) mean annual stocking rate, at three sites in Tasmania (see text for details).

(a) Annual pasture production (kg DM/ha)

Year	Bothwell		Pawtella		Nile	
	Unfertilised	Fertilised	Unfertilised	Fertilised	Unfertilised	Fertilised
1994–1995	790	1,800	- <sup>1</sup>	- <sup>1</sup>	- <sup>1</sup>	- <sup>1</sup>
1995–1996	860	1,440	1,800	4,680	1,130	5,800
1996–1997	2,600	2,640	1,730	2,830	1,080	3,480
1997–1998	- <sup>2</sup>	- <sup>2</sup>	970	980	810	2,870
1998–1999	- <sup>2</sup>	- <sup>2</sup>	1,830	2,810	1,480	3,790
1999–2000	- <sup>2</sup>	- <sup>2</sup>	1,090	970	680	1,600

<sup>1</sup> Trial not begun.

<sup>2</sup> Pasture growth not able to be measured due to dry stubble in the pasture.

(b) Mean stocking rate (DSE/ha)

Treatment	Bothwell	Pawtella	Nile
Unfertilised	2.8	3.3	2.5
Fertilised	3.8	6.0	6.0



Using the stocking rates from Nile and Pawtella, which were considered to reflect the likely carrying capacities in normal seasons (Bothwell experienced drought for much of the period), and using the costs and prices for 1999–2000, gross margin analysis was applied to a medium wool enterprise to compare the likely returns for fertilised and unfertilised native grass pasture over a 10-year period. The cost of fertiliser and clover seed resulted in negative returns on the fertilised pasture in the first year. However, the cumulative returns of the fertilised pasture exceeded those of the unfertilised pasture after 3 years (Figure 13), and averaged over 10 years, returns were 67% higher on the fertilised pasture.

The results indicate that fertilised native pastures may give greater economic returns than unfertilised native pastures. Whether these gross margins will be maintained depends on the price received for wool compared with the costs of animal husbandry and applying superphosphate. The financial returns from fertilising native pastures also assume normal rainfall conditions and utilising the increased pasture productivity through higher stocking rates. Fertilising native pastures may provide a low-cost option for increasing pasture productivity compared with more intense pasture development such as replacing them with sown pastures.

Despite the benefits of fertilising on pasture productivity, the greater variability in seasonal and annual pasture production of fertilised native pastures may make them less suitable for fine wool production. Large variations in pasture production affect wool fibre diameter, leading to a break in the wool and poorer quality wool.

From a whole farm management point of view, it may be more cost-effective to apply extra fertiliser to sown pastures rather than fertilising native pastures, because of the greater response of introduced pastures to increased fertility. This would avoid possible degradation in the condition of native pastures through the loss of native species, weed invasion, and the loss of conservation values with increased soil fertility.

“ Kangaroo grass will quickly disappear if you apply superphosphate, but some of the other native grasses survive quite well under a light fertiliser regime. Wallaby grasses probably grow better with a bit of fertiliser. ”

Returns to applied fertiliser on native pasture

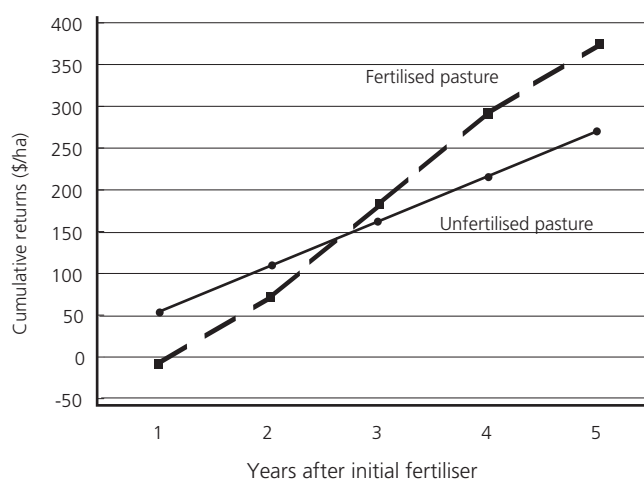


Figure 13. A comparison of the estimated financial returns from fertilised and unfertilised native pastures in Tasmania, based on an increase in stocking rate from 2.9 to 6.0 DSE, and gross margin analysis applied to a medium wool enterprise using costs and returns for 1999–2000.



## Julian Cotton

'Kelvedon', Swansea

'Our hilly native pasture country has been fertilised for quite some time, and it gets about 125 kg/ha of super every three or four years. The steeper and more timbered country has had only a couple of goes with fertiliser. It almost needs a touch up now to replace what's come out of the system.'

'We fertilise our native pastures to replace what we take out of the soil. Plus, on fertilised country, where you've got the nitrogen cycle working properly, the dung seems to break down faster.'

'We notice a big effect on productivity after fertiliser, especially if you add a bit of molybdenum to get a bigger clover response. The cost effectiveness of fertiliser depends on what sort of sheep you've got too. If you've got fine wool sheep, the economics are more likely to be there than if you've got broad-

or medium-wool sheep. Your gross margins are better with fine wool than with medium wool.'

'Fertiliser can effect wool quality, so it's a bit tricky. Clover is notorious for leaping away in the autumn, and it can create a break in the wool. But, we tend not to get a big autumn break.'

'On our north-facing slopes, there was a decline in pasture composition following fertiliser but an increase in productivity—so I guess it's a trade-off. Horehound and thistles are notorious for invading after fertility increases in those areas.'

'It's a bit of a Catch 22: when you start dropping off those input costs, your production goes down.'

# 6

## Managing Weeds in Native Pastures

### KEY POINTS

- » Weeds can markedly reduce the health and productivity of native pastures.
- » The best way to control weeds in native pastures is to prevent them becoming established by maintaining a healthy pasture.
- » Pastures should be grazed strategically so that competition and seed production from weeds are minimised.





## Chapter 6 Managing Weeds in Native Pastures

### WHAT ARE WEEDS?

Weeds are usually defined as unwanted or out of place species. The presence of weeds is often related to poor grazing management, such as overgrazing, which creates bare areas where weeds can invade. It is important to control weeds, because they compete with native pasture species, and degrade the condition and productivity of native pastures. Weeds may also increase the risk of land degradation through soil erosion. It is important to be aware of the weeds in your native pastures and the problems they cause, so you can manage them appropriately.

There are many methods of controlling weeds in native pastures, including grazing management, fire, herbicides and mechanical removal. However, each method creates bare ground, which can encourage further weed invasion. Once a weed has invaded a native pasture, controlling it can be difficult and time consuming, and it is usually impossible to eliminate it from the pasture. Therefore, the best way to manage weeds is to prevent them establishing. This is best done by maintaining healthy and productive native pastures, and minimising the area of bare ground available for weed invasion.

The main groups of weeds in Tasmanian native pastures are annual grass weeds, perennial grass weeds, broadleaf weeds and woody weeds. In some situations, graziers also regard native woody species, such as wattles and prickly box, as weeds.

### ANNUAL GRASS WEEDS

All the methods of controlling annual grasses in native pasture aim to reduce seed production and stop seedling establishment.

#### Strategies that control or reduce abundance of annual grass weeds

Remember that annual grasses germinate and grow only when rainfall and temperature conditions are suitable. Therefore, the strategies below should be timed according to the life stage of the target species rather than the season.

- » Autumn – Light grazing or resting helps maintain the ground cover until the autumn break, which restricts the germination and establishment of annual grasses after the break.
- » Winter – Light to moderate grazing intensity maintains the cover and vigour of native grasses, which increases their ability to compete with annual grasses. Maintaining a dense pasture cover restricts tillering in the annual grasses, and reduces the number of seed heads they produce.
- » Spring – Heavy grazing for short periods when the stems of the annual grasses are beginning to elongate reduces their seed production. Fire does the same thing, if there is enough fuel to sustain a fire.
- » Summer – Light grazing or resting in early summer allows the native grasses to seed and regain their vigour.

Spray topping with low rates of glyphosate (e.g. Roundup®) or paraquat (e.g. Gramoxone®) may be used to control seed production of annual grasses (Harradine 1988).



*Annual grasses, such as barley grass and rats-tail fescue, can produce large amounts of seed if not controlled by grazing or herbicides.*

However, spray topping almost always damages native perennial grasses and other native species. If used, it is best done in spring when the stems of the annual grasses have almost finished elongating and their heads are starting to appear. The best approach to controlling annual grass weeds is to focus on the paddocks that have major annual grass problems and reasonable amounts of desirable species.

## PERENNIAL GRASS WEEDS

Once they become established in pastures, perennial grass weeds, such as browntop bent and Yorkshire fog, can be difficult to control. They are relatively unpalatable, and form mats in the pasture that are hard to break up because livestock avoid them. Strategies to control perennial grass weeds include mob stocking, using a herbicide, burning and promoting a competitive pasture.

Using mob stocking to control perennial grass weeds aims to break up the mats and reduce seed production. Perennial grass weeds are favoured by low stocking rates, and short periods of heavy grazing in winter forces livestock to graze them, reducing the density of the mats. Hoof damage by livestock also helps to break up the grass mats. Increased grazing intensity in spring may help control perennial grass weeds by limiting the production of seed heads and the number and size of seeds produced.



Correct grazing management can help control perennial grasses, such as Yorkshire fog and browntop bent.

Spray topping with glyphosate before the first seed heads emerge is another way of preventing the seed heads forming, but it also damages the native grasses.

Burning may also be an effective way of controlling perennial grass weeds in native pastures, because they are probably less adapted to fire than native grasses.

For strategies for promoting strong, competitive native grass swards, see page 47 'When to graze and rest native pastures'.

*“ I keep on top of the odd bit of Patterson’s curse and other weeds that arrive from time to time. Feed brings in weeds. Mignonette came in about ten years ago, there wasn’t a piece before then. I’m afraid it’s an occupational hazard when you have to bring in stock feed. ”*



### BROADLEAF WEEDS

Many broadleaf weeds are palatable and nutritious. However, if you want to preserve the natural condition of native pastures, they may be undesirable. Strategies for controlling broadleaf weeds in native pastures include minimising the amount of bare ground where they can germinate and establish, reducing their growth and reducing their seed production. Many broadleaf weeds have annual life cycles, so the strategies described for controlling annual grass weeds (page 58) may be used to control many broadleaf weeds. Like other pasture weeds, broadleaf weeds decline when the vigour and competitiveness of the native species increases. Herbicides (e.g. 2,4-D and MCPA) may be used in late winter or early spring to control broadleaf weeds, but herbicides will also damage many of the native wildflowers.

For thistles, resting for extended periods, especially during autumn and early winter, can reduce their abundance and vigour. Resting enables the native grasses to compete vigorously with the thistles for light and space, causing the thistles to become taller, more succulent, less prickly and therefore more palatable to livestock. Strategic short-term, heavy grazing can then be used to force the livestock to graze them and hence restrict their growth and seed set.

Horehound is a broadleaf weed that usually colonises stock camps, but can also spread rapidly into healthy native pastures. Sheep and goats graze horehound plants, but the plants are not usually highly palatable. Burning can kill horehound plants and reduce their soil seed banks, and may be successful when followed by herbicide application to destroy the seedlings. However, it may be difficult to burn effectively in less accessible horehound-infested areas. A biological control agent to control horehound has been released in Tasmania: the horehound plume moth (*Wheeleria spilodactylus*). Although it effectively controls horehound growth, it spreads quite slowly and may need extensive infestations to disperse well.



Weeds, such as thistles, capeweed and erodium, can be controlled by maintaining a strong, competitive native grass sward.

“ Gorse was a huge mess 50 years ago. Now there’s not much of it left. Gorse control isn’t necessary in the sheep paddocks because it provides shelter for lamb-shorn sheep. The inaccessible country was sprayed with a helicopter. All our gorse management is self-funded. ”



## GORSE

Preventing the spread of gorse is fundamental to controlling it. Maintaining a healthy cover of perennial grasses helps suppress gorse seedlings. Several biological control agents have been introduced into Tasmania to restrict the spread of gorse, including the gorse spider mite (*Tetranychus lintearius*), but spraying with herbicide (e.g. Brushoff® or Grazon®) is the best way of controlling extensive infestations.

Burning does not control gorse. However, it does reduce the amount of foliage and promotes green shoots, which are more attractive to livestock and more susceptible to herbicide spraying. Burning also encourages the hard-coated seeds to germinate. Burning is useful when done more than a year after spraying, because it reduces the dead woody stems and allows the pasture to recover. After removing the mature plants, many seedlings often appear. Heavy grazing by sheep and goats may be a good way of controlling the establishing seedlings, and is best done after the gorse has been burnt. Effective control of gorse infestations requires long-term commitment and systematic spraying as new infestations emerge.



*Herbicides can provide effective control for gorse.*

## NATIVE 'WOODY WEEDS'

Although native trees and shrubs may be becoming less common in some areas of Tasmania, in other areas their growth is a serious problem. For example, dense growth of prickly box and silver wattle can reduce pasture quality, and their twigs, seeds and other woody material can contaminate wool. Fire may have an important role in controlling native woody plants as discussed in the next chapter, 'Using Fire to Manage Native Pastures'.



*Prickly box establishing in a native pasture.*

## Richard Bennett

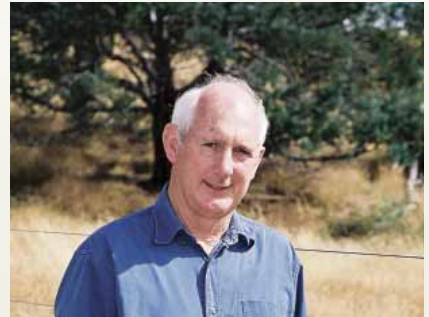
'Ashby', Ross



'Gorse is the main problem on the runs—that and cotton thistles. We only have patches of gorse now, not huge areas, but regrowth is expected for many years. The gorse mite was effective about two years ago, and the gorse stopped flowering. We sprayed the gorse using a helicopter and that was effective. Now, we do follow up sprays with spot spraying to keep it under control.'

## Frank O'Connor

'Benham', Avoca



'One of the biggest problems we have on our native pastures is horehound. It grows on rocky outcrops and steep slopes. We can control it by spraying, but spraying leaves areas of bare ground for it to grow back in, and that's exactly what happens.'

'To get good kills, we need to spray it fairly early, as soon as it greens up after winter, but before its root system develops properly. The only satisfactory way to spray it is to use a helicopter, as the areas where it grows are difficult to get to with vehicles.'



# Using Fire to Manage Native Pastures

## KEY POINTS

- » Lowland native pastures are adapted to fire.
- » Fire is a powerful tool that should be used with care and thought.
- » Fire can help maintain the health and diversity of native pastures.
- » Fire can be used to control woody plants or promote their regeneration.



## Chapter 7 Using Fire to Manage Native Pastures



*Fire provides an effective means of removing rank, dead plant material.*

### ROLE OF FIRE IN NATIVE PASTURES

Fire plays a vital role in the selection and maintenance of the pasture plants and trees that make up Tasmania's native pastures and bush runs. Much of the flora has evolved in an environment where fire occurred regularly. Tasmania's native people burnt the landscape for tens of thousands of years before Europeans arrived. Plants such as eucalypts, teatrees (*Leptospermum* spp.) and paperbarks (*Melaleuca* spp.) have their seed protected in thick woody seed capsules, and have thick bark to protect the living part of the stem underneath, from which new shoots arise after fire. Alternatively, they resprout from woody bases (lignotubers) after fire. Native grasses and other herbaceous species are also able to regrow after fire from bulbs, corms and tap roots at or below ground level.

Different plants and vegetation types need different fire regimes, that is, different frequencies and intensities of fire. While vegetation types such as riparian scrub and rainforest do not need fire for regeneration, most bush degrades in the long-term absence of fire. However, grazing by domestic livestock such as sheep and cattle can act as a surrogate for fire in many grassy ecosystems by reducing the biomass of the competitive, dominant native grasses.

“ In the early days, they used to burn every year. They'd muster at the end of spring and drop matches as they went. They carried twice the number of stock then as now. We can't burn now due to fire restrictions. ”

Fire is a powerful management tool that should be used with care and understanding. It can have diverse effects on the composition and growth of native pastures, depending on the season, amount of herbage present, frequency and intensity of burning, and grazing management after burning. The main reasons for burning are to control woody plants, reduce the wildfire hazard, and stimulate the green shoots by removing dead plant material. Fire can be used to control some invasive weeds if the weed's preferred fire regime differs from that of the pasture species. The objectives of burning should be determined beforehand and should form part of the long-term pasture management strategy.

The flexibility of fire as a management tool in native pastures has been markedly reduced by the strict regulation of fires by fire authorities. Many graziers say it is difficult to get a permit when they want to burn, and the burning season is now shorter due to the drier climatic conditions of the past few decades. The decrease in the frequency of fires in Tasmanian native pastures has been associated with an increase in the abundance of woody species such as silver wattle and prickly box.

## EFFECT OF FIRE ON PASTURE SPECIES

The most obvious effect of fire is to remove dead material, and replace it with palatable regrowth. In general, fires damage green, actively growing species, but not dry, dormant species. Fire can be used to maintain the abundance of wildflowers and other small native herbs when grazing is not possible. These herbs are promoted by opening up the spaces between the dominant grasses. Fire also creates areas of bare ground where seedlings of desirable and undesirable pasture species can germinate. However, fire is not essential for maintaining healthy native pasture, because grazing can also reduce the competition and shading from dense grasses.

## EFFECT OF FIRE ON WOODY PLANTS

Fire has diverse effects on the abundance of trees and shrubs in native pastures, depending on the frequency and intensity of burning, and the subsequent use of grazing. It is important to determine whether you want to promote or retard woody growth. If the aim is to stop woody species invading native grassland, regular fire followed by grazing can control woody plants. In contrast, the absence of fire or grazing encourages woody plants to invade.

When native woody plants become established in native pastures, a hot fire and subsequent grazing may be needed to kill them. Unfortunately, the hot 'summer' fire needed to control the saplings of woody species is often no longer a viable management option.

## WHEN TO BURN

Native pastures should be burnt only if there is good reason for doing so—not just for the sake of it. Thus, burning should be used only when the pasture condition indicates that it would be useful.

Autumn is usually the best season to burn most lowland pasture species, because by then the plants have finished flowering and setting seed. It is also the preferred time for wildlife, because most species will have finished their breeding cycle. The seasonal conditions in autumn also make it a good time for controlled burning.



*Dry feed is replaced by highly palatable regrowth after burning.*





Grazier viewpoint Using fire as a management tool



## Major Ralph Cameron

'Kingston', Nile

'On Buffalo Run, which covers about 2000 acres, we run 1400 sheep for most of the year. The run is spelled in December. Regular burning has allowed us to maintain the run in good condition for grazing.'

'The run has areas of tussock and other rough feed, which needs to be burnt every few years to open it up and let the better grasses between the tussocks get away. The tussocks also provide valuable feed after burning. It's important not to overgraze after burning or the tussocks and other grasses will be damaged.'

'We burn in spring or autumn. We use a cool fire by burning in the morning or evening. If you burn in the heat of the day, the hot fire will damage the roots. We burn small patches at a time to create a patchwork of areas at different stages of regrowth. This means that there's always some shelter, as well as green feed. It also means the fire is less likely to get away.'







# 8 Managing Native Pastures for Conservation

## KEY POINTS

- » Native pastures and bush runs are a high priority for conservation.
- » Native pastures can be managed to maintain their productivity and conservation values.
- » Native pastures need active management to maintain their conservation values.
- » The key tools for maintaining the health and diversity of native pastures are grazing and fire.
- » Usually, the best way to conserve the biodiversity of native pastures is to maintain the long-established grazing regimes that have favoured their conservation to date.
- » Excluding livestock from native pastures during 'good' spring seasons encourages greater recruitment of native plants.
- » If native pastures are grazed too soon after fire, livestock will damage the regenerating trees and shrubs.
- » Grazing during drought or after fire can eliminate tussock grasses from native pastures.
- » The best time to burn is autumn, because it allows the native plants to set seed and the native animals to finish breeding.

## MANAGING NATIVE PASTURES FOR BIODIVERSITY

Native biodiversity is an important component of healthy native pastures, and sustainable grazing management can maintain and enhance this biodiversity. The past few decades have seen growing community pressure to protect native biodiversity, particularly in agricultural areas where much of the native vegetation has been converted to pasture and cropping, and some native animals and plants have become extinct or threatened. This concern has led to environmental legislation and regulation. Increasingly too, consumers are demanding good environmental credentials for the products they buy, leading to the growth of environmental quality assurance and accreditation schemes. Graziers may benefit from meeting the new environmental standards by gaining access to niche markets.

Graziers have managed their native country in many ways. There is no one way to correctly manage for native biodiversity, because different species are favoured by different management regimes. Some of Tasmania's most highly valued fine and superfine wool is produced on healthy native pastures with a diversity of grasses and wildflowers and few weeds. The sustainability of these pastures depends on continuing the existing management regimes, and responding appropriately to changing environmental conditions.



*Threatened plant species, including grassland paperdaisy (top) and characteristic species, such as billy buttons (Craspedia sp., bottom), in diverse native grasslands grazed by sheep.*



## MANAGING HABITAT FOR NATIVE PLANTS

Many native wildflowers rely on grazing to reduce the dominance of native grasses, and to create the inter-tussock spaces or gaps needed for them to establish and flourish. Healthy pastures can have more than 60 native species per 10 m<sup>2</sup>. When the inter-tussock spaces close up, this density can drop to as low as 10–15 species per 10 m<sup>2</sup>. The spaces are important for rare native annuals, lilies and orchids. Research in infrequently grazed native pastures, ungrazed grassy roadside verges and highland grasslands of Tasmania has shown that a lack of grazing can lead to reduced populations of herb species. On the Tunbridge Tier Road, a travelling stock route, threatened wildflowers such as grassland candles and grassland cupflower (*Colobanthus curtisiae*) have disappeared in the 10 years since graziers started trucking their sheep rather than using the traditional stock route.

Livestock grazing can be used as a conservation management tool to preserve many threatened plant species, especially in the absence of other herbivores. However, some species are sensitive to grazing, because they are highly palatable and not adapted to recovering from grazing. Some species sensitive to grazing are listed as threatened and need continued protection from livestock, including the soft peppergrass and spur velleia. These species persist around farm houses, in cemeteries and along roadside verges rather than in paddocks.



*Tasmanian native grasslands provide habitat for many wildflowers that are relatives of garden flowers.*

In the absence of grazing, fire has an important role to play in maintaining the inter-tussock spaces. Fire also helps many native species germinate.



## MANAGING HABITAT FOR NATIVE ANIMALS

Native vegetation provides essential habitat for native birds, mammals, reptiles and invertebrates. Birds play an important role in maintaining ecosystem health by reducing the number of insect pests, pollinating plants and dispersing seeds. Some smaller mammals, such as bandicoots, potoroos and bettongs, and reptiles, such as lizards, also feed on insect pests and play an important role in dispersing fungi.

Invertebrates are the most numerous and diverse animals in native pastures. While some invertebrates are pasture pests, most play a valuable role in ecosystem functioning. For example, soil mites, a highly diverse and abundant group in Tasmanian native pastures, help break down organic matter and recycle nutrients. Other invertebrates pollinate plants and disperse seeds, while others feed off, or parasitise, invertebrate pests such as corbie grubs.

Some general principles can be followed when managing bush for animal habitat. Tree hollows are important for many species, especially parrots and owls, and should be retained. Large old trees, even dead ones, are used by many birds and bats for nesting and foraging. They also provide vantage spots and perching trees for many species, including eagles, hawks, owls and ducks. Birds such as wrens, robins, honeyeaters and pigeons need a diverse and healthy understorey. Once the understorey is degraded, aggressive birds, such as noisy miners, move in and displace the bush birds.

Reptiles and small mammals, such as bandicoots, bettongs, quolls and devils, need understorey, such as sags, tussocks, dense bracken and small shrubs, for habitat. Maintaining patches of rank grass growth, dense understorey and gully vegetation on the farm is important for conserving native fauna. Logs on the ground, dead wood, leaf litter, sticks, rocks and stones are also important components of the bush for native animals.

Different invertebrates may have different habitat requirements for food, shelter and reproduction. Recent observations in the Midlands of invertebrate populations associated with different vegetation types and management practices showed that invertebrate species composition varied markedly between the different vegetation types. Within vegetation types, the species composition varied markedly, depending on the grazing and burning regimes used. These observations emphasise the importance for native biodiversity of using a variety of management regimes in native pastures.

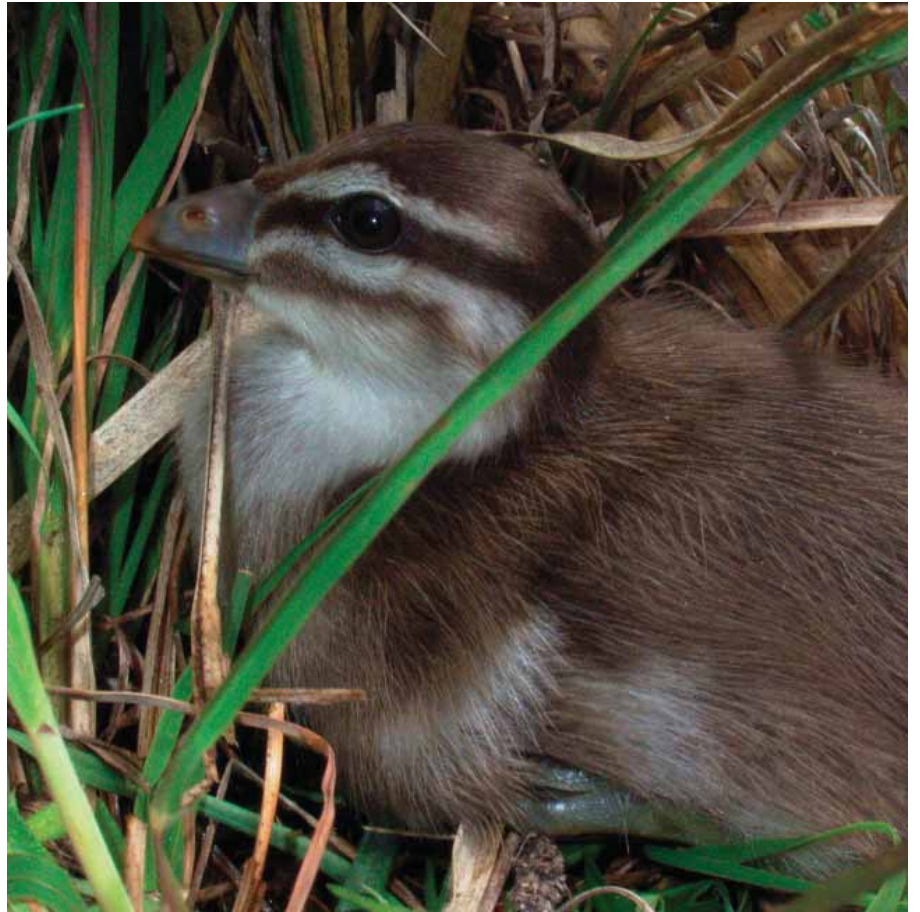


Native plants provide habitat and food for native insects.

“ It’s important to maintain the trees and tussocks for their shelter value, secondary to their feed value. ”

“ I think our management also caters for the small mammals, reptiles, birds and insects that occur in native pastures. At the time they’re breeding in spring and summer, we’re not using that ground for grazing, so they’re not being disturbed.

“ The native animals have evolved in the native grasslands, it’s their habitat, and if you don’t maintain their habitat you lose them. If a tree falls over in the bush, we don’t clean it up. Where a tree has fallen, stock can’t get in, and it becomes a patch with overgrown grass, a refuge for a small mammal or a lizard. We also have a rule that dead trees in the bush are not cut down for firewood, because we have to maintain the bird nesting sites. ”



Some native animals use native grasses and sedges as protection during breeding, including this pacific black duckling (*Anas superciliosa*).



## Henry Foster

'Fosterville', Campbell Town

'I'm lucky to have been the manager of a property that still has a large area of native pasture. Our native pastures have great biodiversity value because of the wildflowers and all the other plants and animals they provide habitat for. A key objective in managing these native pastures is to preserve this biodiversity.

'To do this, we graze native pastures from late summer to early spring, thus allowing the grasses and wildflowers to complete their life cycle free of stock. Allowing them to seed is important for maintaining their seed banks in the soil. And, of course, by doing this, it gives you the opportunity to watch them flowering and to see them in all their glory.

'If you don't graze native pasture, it becomes very overgrown, and you end up with a mass of dry, dead material that tends to smother everything. So, to maintain its biodiversity, native pasture needs to be grazed fairly regularly. The alternative is to

burn it, which is quite a good way of getting rid of the excess dead material.

'Also, if you want to maintain native pastures in good condition, it's essential that you don't fertilise them. A good *Themeda* pasture will quickly disappear if you apply superphosphate.

'Often the populations of wildflowers are quite sparse: a patch here and a patch there. There are several native plants I've seen that occur in very small populations in only a few areas. In the case of the black-tipped spider orchid, we have found them only in one particular area, and it's probably an area of only one hectare.

'I don't believe in putting fences around these areas as they cause more problems than they solve. By managing our native pastures so we don't graze them over spring and summer, we're able to maintain all the species that occur there.'





# Promoting Tree and Shrub Regeneration



## KEY POINTS

- » Tree and shrub regeneration is essential if bush runs are to be preserved for the future.
- » Natural regeneration is the cheapest and most effective way of retaining the bush on your property.
- » Getting the bush to regenerate can be difficult.
- » Plan to regenerate each bush area on your property over your lifetime on the farm.

### HOW DOES NATURAL REGENERATION OCCUR?

Natural regeneration is the process by which old trees and shrubs replace themselves. It is by far the best form of regeneration. Natural regeneration results from the germination of seeds that have fallen from existing plants, and the resprouting of shoots from existing stumps and roots. After disturbance, most species recover by resprouting rather than germinating.

Natural regeneration is a cheap and effective method of re-establishing or rehabilitating bush on farms, particularly on a large scale. It is cheaper to fence off and manage existing stands of bush than to re-establish trees for shelter and other purposes. There are many other advantages too. Natural regeneration comes from existing plant material, so it is adapted to local conditions, and it helps preserve the genetic make-up of the bush on the property.

### MANAGE GRAZING TO ALLOW REGENERATION

Fencing allows stock grazing in the bush to be controlled. If regeneration occurs, exclude livestock until the young trees are out of the reach of livestock, which may take 3–5 years or more. Leave dead branches on the ground, because they create ‘cages’ over the young seedlings, which protect them from browsing animals. Placing old branches over young seedlings does the same thing.

Dense grassy swards can limit regeneration, so using mobs of cattle or sheep for short periods to crash graze can promote regeneration by reducing competition. Hoof action during short periods of intensive grazing can also bury the seeds and protect them from predators.

“ Our prime focus to restore these degraded native pastures is to first get the trees and shrubs growing. Then we will get the native grasses growing, and then we can make decisions on the best way of utilising the grasses. If we don’t do this then we have no decision to make. ”



Regenerating trees in areas fenced off to control stock grazing on river flats (left) and hillslopes (right).



## LACK OF TREE AND SHRUB REGENERATION

There are many reasons why bush runs may not regenerate successfully, including

- » Livestock are allowed access to regenerating areas for too long – In many cases natural regeneration is occurring, but stock graze the young seedlings as they appear.
- » Competition from grasses and other weeds – Dense mats of grass prevent native seeds germinating, compete for resources, and suppress young seedlings. When grasses become rank, other plants often cannot flower and set seed because of competition from the grasses.
- » Competition from native trees – Many large native trees, including eucalypts, she-oaks and bull-oaks, suppress regeneration around them through a number of mechanisms, including competing for soil moisture, and having a dense layer of litter beneath them.
- » Lack of regenerating fires – For many species, recruitment is almost non-existent without fire. However, the role played by fire in natural regeneration varies depending on the vegetation type and species. (See the *Tasmanian Bushcare Toolkit* by J. B. Kirkpatrick and L. Gilfedder, 1999 for more information about the role of fire in different bush types.)



*Eucalypt seedlings often germinate following fire or drought because they require bare ground and lack of competition to survive.*

- » Soil compaction – The heavy hooves of livestock, particularly cattle and horses, compact soil and destroy soil structure. Using heavy machinery and vehicles, particularly when the soil is wet, has the same effect. Compaction makes it more difficult for seedlings to germinate

and establish their roots. If they do germinate, they are vulnerable to moisture stress, because less water penetrates compacted soils. Perennial plant roots, soil microbial activity and invertebrates can reverse compaction.



*Livestock have been excluded from the corner of this paddock to promote tree regeneration.*



## Chapter 9 Promoting Tree and Shrub Regeneration

- » The cryptogamic mat is gone
  - The mat of cryptogams (mosses, lichens and algae) between the tussocks encourages native seeds to germinate.
- » Predation of young plants
  - Hares, deer, rabbits, wildlife and livestock can eat young seedlings, as can caterpillars, beetles, nematodes and other invertebrates.
- » Seed harvesting by ants – Ants can harvest almost all the seed fall of some species, particularly wattles and bush peas. However, ants are also beneficial: they play an important role in establishment by dispersing seeds and increasing soil porosity.
- » Drought and poor conditions
  - Many species need several consecutive wet winters to germinate and survive, because the natural recruitment and survival of seedlings is low. In addition, grazing, burning and trampling can lead to high mortality of the few seedlings that establish.
- » Natural seed production is low
  - While some plants produce large amounts of long-lived seed, others do not. Many species produce little seed in most years, but have occasional years of high seed production that result in mass regeneration. Management should be aimed at protecting the seedlings that establish following mass seeding events.



*Mosses, lichens and algae are all part of the cryptogamic mat.*

“ To see the trees growing back and to know that these areas will continue to provide grazing in the future mean—it’s a win–win situation. Apart from the economics, it’s the aesthetic considerations that make what I’m doing worthwhile. ”



### USE FIRE TO ENCOURAGE REGENERATION

Experiment with fire to encourage regeneration. Burn a small patch of bush to see if any regeneration occurs. Seeds stored in hard cones, such as the seeds of silver banksia (*Banksia marginata*) and needle bush (*Hakea* spp.), and eucalypt seed stored in gum nuts are released after fire. Fire also creates an ashbed for many species. However, remember that intense fires may kill old trees.



## Roderic O'Connor

'Connorville', Cressy

'I'm trying to encourage the regeneration of trees and shrubs on the superfine wool country of 'Connorville', because I want to make sure that wool production on this country is ecologically sustainable.

'Elsewhere on the property, native regeneration is encouraged in gullies and shelter belts. We don't necessarily exclude grazing from the areas identified for rehabilitation. For example, in the gullies, we allow limited grazing by sheep but not cattle.

'Browsing by wildlife is a significant problem. We have a game management plan that has enabled us to control browsing animals. In some places, in the last 18 months, there's been phenomenal regrowth. I'm amazed that even after years of being browsed, given the right conditions, the trees and shrubs can come back.

'In order to maximise the natural regeneration, I think we need to

have more dry stock. We need to be able to move the sheep when required, rather than having a fixation on set stocking. To do that, we're putting in additional fencing, so we can manage the runs a bit better using rotational grazing.

'I would like to set aside a lot more areas for regeneration, but economics plays a big part here: at the end of the day I have a business to run. So, it has to be done slowly. Good property management decisions take time to implement, rather than being a quick fix. I think you have to take a 20–30-year view, a generational view.

'It's absolutely crucial to get someone to validate that you're managing the right areas for regeneration correctly. You need to get scientific advice. It's essential that governments continue to provide this advice to landholders, because of the social and ecological benefits that flow from better managing our native pasture and forest resource.'



# 10

## Managing Riparian and Wetland Grasslands

### KEY POINTS

- » Riparian and wetland areas are vulnerable to overgrazing.
- » The best way to manage riparian and wetland areas is to exclude livestock.
- » Livestock may be allowed in riparian areas for short periods to manage weeds, but only when the stream banks are dry and stable.

## CHARACTERISTICS OF RIPARIAN AND WETLAND GRASSLANDS

Riparian vegetation occurs along the margins of rivers and wetlands. It may differ from the surrounding vegetation in many ways, because the plants are adapted to living in a moist environment. Riparian grasslands tend to have few trees, and to be dominated by tussock grasses, with wildflowers in the spaces between the tussocks. Grassy woodlands are also found along rivers and surrounding wetlands.

Silver tussock grasslands are found on moist alluvial soils along rivers and on the adjacent floodplains. Extensive areas of silver tussock flats occur along rivers such as the Macquarie, South Esk, Meander and Lake, and some of their tributaries. These areas are often highly disturbed. They may have a good cover of silver tussock, but they may also have a large proportion of introduced grasses, docks, thistles and flat weeds.

Where the silver tussock grass is in reasonable condition, other grasses such as weeping grass, wallaby grasses and spear grasses may also be common. In wetter areas, aquatic species, such as watermilfoil (*Myriophyllum* sp.), running marshflower (*Villarsia reniformis*), water buttons (*Cotula coronopifolia*), jointed twig-sedge (*Baumea articulata*) and greater water-ribbons (*Triglochin procerum*) may persist, even though no surface water is present. Kangaroo grass and wallaby grass pastures can also be found along rivers, and may contain a diverse range of herbaceous species, such as blue bottledaisy, southern cranesbill, prickfoot, kidneyweed and various lilies and sedges.



Fenced off silver tussock flats (left) on the Macquarie River.

Wetlands are scattered along the floodplains of the South Esk basin and on the plains of the Midlands. The wetlands along rivers are usually shallow depressions or billabongs formed when the meanders have been cut off from the main channel. Some wetlands form in areas where floods break out onto low-lying areas. The wetlands on the grassy plains of the Midlands have been created by the action of wind forming a dune along the margin of the wetland or by erosion forming a pan. These wetlands are important habitats for aquatic insects, frogs and birds, and they can easily not be recognised when they have dried out in summer.

A healthy cover of native grasses binds stream banks, preventing erosion, and filters sediments and nutrients from adjacent areas. This in turn helps maintain good water quality and provides shading at the stream edge. Maintaining these areas protects the health of the river and its catchment.

## GRAZING MANAGEMENT IN RIPARIAN AND WETLAND GRASSLANDS

Riparian and wetland environments are vulnerable to overgrazing. Inappropriate grazing management can substantially reduce the cover of silver tussock and other native grasses, causing the stream banks to become susceptible to erosion, and reducing water quality when flows are low. In Tasmania, it has been shown many times that excluding livestock leads to rapid recovery of silver tussock grass flats and the return of other native grasses.

Riparian areas should be considered 'special needs' paddocks in the property's management plan. Grazing regimes should be related to the condition of the area, and the management objective should be to maintain or improve the condition of the pasture. For example, if the area is healthy and weed-free, excluding livestock completely is often the best option. Maintaining

the area in good condition is much more cost-effective than trying to rehabilitate it later. However, if it contains weeds, it may need limited grazing to prevent the weeds becoming a problem.

### **FIRE MANAGEMENT IN RIPARIAN AND WETLAND GRASSLANDS**

Fire does not usually occur in riparian areas, so it should be excluded if possible. Riparian and wetland areas are moist environments, and may be less adapted to fire than other environments. In the event of an unplanned fire, livestock should be excluded, so the vegetation can recover. Fire may also trigger the germination of weeds, such as gorse, which will need time and effort to control.

### **WEED MANAGEMENT IN RIPARIAN AND WETLAND GRASSLANDS**

If riparian vegetation contains weeds, such as gorse, hawthorn or thistles, strategic grazing may be needed, at least until the weed problem has been controlled enough for more effective methods to be used. In these circumstances, livestock can be used to graze targeted, weedy areas for short periods of time when the banks are relatively dry and stable. Long-term control of woody weeds needs mechanical or chemical control methods. Riparian and aquatic areas are sensitive environments, so advice should always be sought before undertaking such control operations. Many herbicides should not be used in or near aquatic environments, and inappropriate use of machinery can cause damage. Weed control requires long-term commitment, and may involve a



*Silver tussock grassland fenced off with a wetland.*

great deal of time and expense. After the initial control work, follow-up work is essential to ensure that the weeds do not re-establish.

### **PROVIDING LIVESTOCK WITH ACCESS TO WATER**

If access to water is important, it may be necessary to establish alternative watering points. Formed access points at carefully selected locations will not cause undue damage. Boggy areas and high flow areas, such as the outside of meanders and bends, should be avoided. Sections of straight channel with a gently graded slope into the stream are the best access points. Walkways of concrete, logs or similar materials can be built to protect the stream surface. Riparian fencing needs careful planning because flooding is a continual problem. Several alternatives can be used, including hanging fences, drop fences and electric fences.

Further information about managing riparian areas can be found in the Land & Water river management guides mentioned in the bibliography.



*Riparian wetland on the South Esk River. This ephemeral lagoon is fringed by silver tussock and sedgeland. Livestock are excluded, except in dry times.*





## Lindsay & Rae Young

'Lewisham', Ross

'We have five kilometres of river frontage at 'Lewisham'. Fencing off the river was the first step in our management plan.

'There were a lot of tracks and eroded areas where stock came in to water, and we had a lot of trouble with stock getting caught in muddy areas in the river in summer. We also used to get a lot of two-way sheep traffic between our property and the neighbouring one. This meant that if one of us got a disease in their sheep, it would have spread to both properties. We wanted to get Ovine Johne's accreditation, and this was probably the catalyst that made us fence off the river.

'We use four-wire electric fencing along the river, which has been successful. Most of the fence is under water in flood, so we get a lot of trash deposited on it. In the early days, we used to go and clear it every time it flooded, and it became a chore. It's less of an issue now that there's a lot of regrowth behind it. We try to make fence maintenance a

summer job now, after the flood period. So it's not a huge issue maintaining it, but it's something that has to be done.

'There were a lot of willows along the river, and we worked with our neighbours to remove them. Willow management is ongoing, because every year we have to control the regrowth. We get a contractor to spot spray the regrowth, which only takes him a day. Our neighbours do the same.

'A lot of the river has been planted out with native trees and shrubs grown from seed collected locally. Losses have been high, due mainly to browsing by game, but the ones that have survived are doing really well. We will continue to plant new areas every three or four years, so we have a mixed-age stand of trees and shrubs.'

# 11

## Managing Native Pastures during Drought

### KEY POINTS

- » Drought is a natural part of the Tasmanian environment, and it should be taken into account in all property plans and management procedures.
- » During drought, destock rather than overgraze native pastures.
- » Allow adequate time for native pastures to recover following grazing during and after drought.
- » Overgrazing native pastures during and after drought can have a deleterious effect on long-term productivity.

**WHAT IS DROUGHT?**

Drought is not just a period of low rainfall. Rather, it is a prolonged, abnormally dry period where not enough rain falls for normal pasture growth. Droughts often extend over several years, relieved only by brief, transitory rains. Over longer time periods, there may be periods of a decade or more that seem 'drought prone'. During these low rainfall periods, not every year is dry, but the rainfall in most years is below the long-term average and there are consecutive years of drought.

The lower rainfall areas of Tasmania, such as the Midlands, Derwent Valley, Fingal Valley, East Coast and Flinders Island, have experienced a sustained dry period with lower than average rainfall for most years since the mid 1970s (Figure 14). Although extended periods of lower than average rainfall are evident further back in Tasmania's rainfall records, evidence from

climatic modelling suggests that the present dry period is related to global warming associated with the greenhouse effect.

Australian state and federal governments have recently acknowledged that drought is part of the natural variability of Australia's climate, and have restricted drought relief for farmers and agricultural communities to times of so-called 'exceptional circumstances'. In other words, farmers are expected to cope with normal rainfall variability and the occasional drought, so drought relief is available only for unusually long or severe droughts.

For pasture growth, the timing and quantity of rainfall can be just as important as the total annual rainfall. Regular rainfall events that maintain soil moisture without surface run-off are the most effective. Rainfall coming in very light falls at regular intervals or in a few large falls is far less effective.

**EFFECTS OF DROUGHT ON NATIVE PASTURES**

The most obvious effect of drought on native pastures is a lack of pasture growth. Most native grasses are highly tolerant of drought conditions. Healthy, vigorous plants use their root systems to access water deep in the soil, or they become dormant until soil moisture increases. However, when native grasses are grazed heavily just before a drought or after flushes of growth following light rains during a drought, their ability to regenerate and regrow after the drought may be severely reduced. Heavy grazing during dry periods, especially in summer, can expose the growing points of native grasses to high temperatures, which may kill the plants. For example, tussock grasses can provide a good fodder reserve during drought, but if the tussocks are grazed too heavily they may die completely. If they do survive, they may take several years to regain their former vigour.

**Rainfall variability in the Midlands of Tasmania**

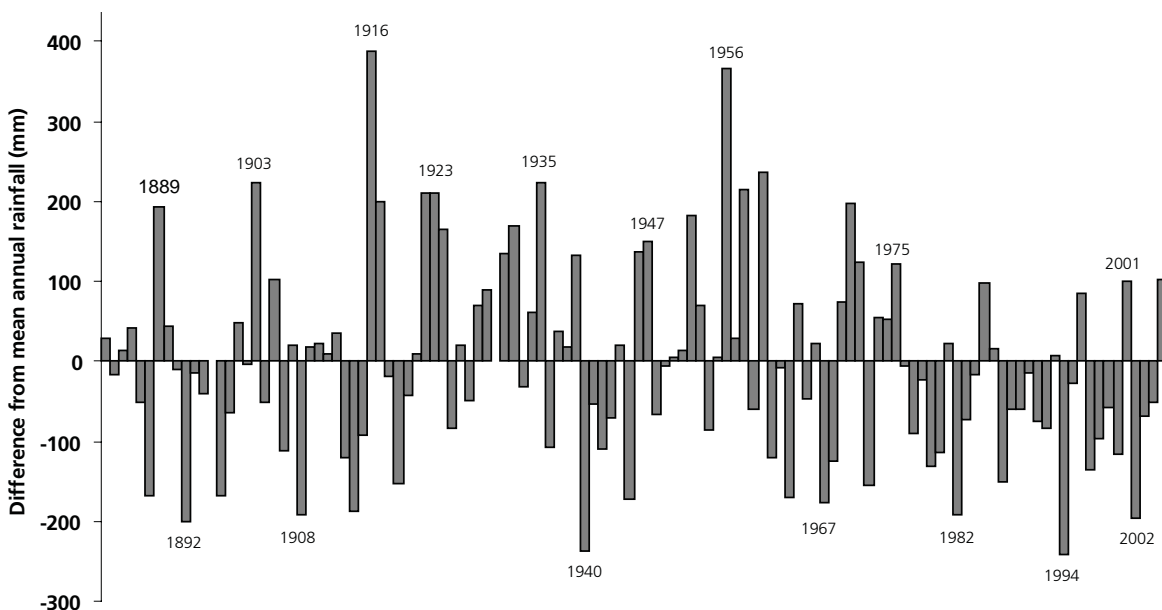


Figure 14. The Midlands of Tasmania has experienced an exceptionally dry period since 1976. The annual rainfall records for Oatlands for 1883–2005 are shown as the difference from the mean annual rainfall of 553 mm.



## MANAGING NATIVE PASTURES DURING DROUGHT

The ways in which native pastures are managed during drought have major effects on the sustainability and long-term productivity of grazing enterprises.

### Have a plan

Drought is one of the biggest uncertainties affecting farm enterprises, and graziers are increasingly being encouraged to be self-reliant in managing rainfall variability. Although it is tempting to avoid thinking about drought when times are good, having a drought plan—preferably written—is beneficial. A drought plan may involve reducing stock numbers if specified amounts of rain do not fall by specified dates, categorising paddocks according to erosion risk, and selecting one or two paddocks to be used as ‘sacrifice paddocks’ so that not all the pastures become degraded. It is better to use already degraded pastures on flatter areas as sacrifice paddocks, because they can be resown later, and they are not highly susceptible to soil erosion.



*Native pastures can be seriously degraded if grazing is not controlled during drought.*

The most basic preparation for drought is to have a plan for destocking and accumulating water, fodder and cash before the drought begins. Farmers are being encouraged to invest and save money in good years, so they can be more financially secure during drought years. However, the interests of short-term profitability may conflict with the long-term sustainability of native pastures during drought. During normal rainfall years, higher stocking rates are more profitable.

However, higher stocking rates make grazing enterprises more susceptible to drought, and result in more rapid degradation of the pasture resource. The key is to destock early in the drought by selling, lot feeding or agisting out livestock before fodder reserves are exhausted.

## Chapter 11 Managing Native Pastures During Drought

### Use native pastures as feed but don't degrade them

Native pastures are commonly used as feed during drought. Under prolonged dry conditions, the damage to native pastures can be minimised by removing livestock as soon as planned minimum levels of pasture mass (e.g. 500 kg DM/ha) or maximum levels of bare ground (e.g. 30%) occur. These levels should not be exceeded. Overgrazing of native pastures should be avoided at all times, but overgrazing is particularly critical during drought. If grazed too heavily during drought conditions, native grasses may be depleted or eliminated from native pastures, leaving the soil susceptible to erosion and creating bare areas where weeds can invade. The invasion of weeds may be irreversible, and may cause a decline in pasture condition and productivity. Unlike sown pastures, most native pastures cannot be resown.

### Monitor the feed available

The major problems faced when managing pastures during drought are not knowing if a dry period will turn into drought, and not knowing how long a drought will last. Careful monitoring of soil moisture, pastures and livestock is recommended to improve drought management practices. Continuous monitoring of the available feed and livestock requirements allows feed shortages to be identified early, and provides the opportunity to respond quickly by destocking or buying fodder.



*Sheep waiting to be fed grain during drought. Watch out for weeds in areas where grain or hay has been used.*

### Determine the number of livestock early

Some graziers argue that properties are overstocked if it is necessary to feed grain during a drought. Developing a contingency plan for selling the least valuable livestock first allows the resource base, including stock bloodlines and pastures, to be kept relatively intact. The arrival or otherwise of the 'autumn break' is often regarded as a good time to reassess winter stocking rates.

In poor seasons or when the autumn break is late, it may be useful to reduce stock numbers so the demand for feed matches that available. Nominating a 'disposable' (can be sold when needed) portion of the flock allows graziers to respond rapidly to drying conditions and possible feed shortages. For this strategy to be successful, the priorities for disposing of stock

must be clearly defined ahead of time, and may include stock already identified for culling, old wethers, old ewes and younger wethers. Young breeding ewes are often the highest priority for retention in order to maintain the genetics of replacement stock, though the fertility of these ewes is often compromised by poor seasons.

To make sure the demand for feed does not exceed that available, the critical periods in the year for feed availability should be identified. For instance, in most districts, if the autumn rainfall has been low and little feed is available by the end of April, it will be too cold for significant pasture growth before the end of September, even if good rain falls in winter. In such circumstances, stock numbers should be reduced in autumn or concentrates sourced for supplementary feeding.

### Avoid overgrazing after drought

After a drought breaks, the pastures need time to replenish their energy reserves. Most drought damage occurs as a result of continuous grazing of new growth after the drought breaks. Allowing adequate time for the pastures to regenerate and recover after a drought results in more rapid growth rates. Ideally, wait until at least 1000 kg DM/ha is available before grazing. After a bad drought, wait until the native grasses have flowered.

Take care also to control any weeds that have germinated in areas where imported feed has been fed out.



*These silver tussocks have been heavily grazed during drought, and will need resting to allow them to recover.*





## Lindsay Nicolson

'Bonneys Plains', Conara

'Drought is how you perceive it. We have periods of low rainfall, but we never have periods of no rainfall. So, you've just got to look at what rainfall you get and manage according to that.'

'During periods of low rainfall, we move stock on to our native country. We're fortunate that 70% of the property is native, because it means we've got a fall back position to cope with dry periods.'

'If a dry spell persists, our policy is to reduce stock numbers. We try not to leave it until the stage where stock are flogging the pasture out or exposing a lot of bare earth. We get rid of the oldest stock first. We might sell two years of cast-for-age stock, rather than one.'

'In the past, we just ran everything in the native country during dry periods and didn't destock. Looking back on that policy, it wasn't so good for the native country.'

'There's still a perception that you can use native pastures as a store of feed that will persist regardless of stocking rates during dry periods—but I don't think that's the case.'

'When rainfall returns to normal, we try to rest our native pastures for 12 months. I think that having a break following a dry period is critical—allowing things to recover rather than grazing them immediately. If you rest native pastures for a full 12 months after a dry period, it's just incredible how much they recover. Resting native pastures following a dry spell is probably just as important as what you do during the period of low rainfall.'

'You have an abnormal amount of bare ground after a dry period. If you can allow the grasses to set seed in the following season, the chances of regeneration are pretty good. I've kept a close eye on that, and you do get some good regeneration if you're lucky enough to get a half-decent season following the dry period.'

# 12

## Monitoring Change in Native Pastures

### KEY POINTS

- » Monitoring native pastures provides useful information about changes in pasture condition, and gives early warning of potential problems, such as loss of native grasses and soil erosion.
- » Fixed-point photographs provide a visual record of changes in the pasture.
- » Monitoring pasture composition (species presence and abundance) provides the most useful information about changes in pasture condition.
- » Monitoring the condition of pastures and livestock allows better management of native pastures.

### WHAT IS MONITORING?

Pasture dry matter production, species composition and soil attributes change constantly. These and other features combine to determine the 'condition' of a pasture. Monitoring involves taking regular measurements to identify changes in pasture condition.

Most graziers monitor the condition of their livestock, and many graziers also monitor the condition of their pastures, most commonly by looking at the pasture and making judgements about its potential to support grazing. This information allows graziers to move livestock before they lose condition, and before the pasture becomes overgrazed. However, unless the information is recorded, changes in the condition of a pasture over time may not be detected.

This chapter shows how pasture monitoring can improve grazing management and maintain pasture productivity. It also describes some objective methods for monitoring native pastures.

### WHY MONITOR NATIVE PASTURES?

- » To determine the condition of a pasture – Monitoring allows you to determine the current condition of a pasture, and compare it with previous measurements and other pastures.
  - » To provide a permanent record – The human memory is unreliable, selective and short-lived, and cannot be relied upon to detect long-term changes in pasture condition. Monitoring provides a permanent record that can highlight gradual changes in a pasture over the years, and help determine whether the condition is stable, deteriorating or improving. Monitoring highlights potential hazards, such as weed invasion and soil erosion, and is essential to avoid the gradual loss of desirable species, such as productive perennial grasses.
  - » To evaluate the effectiveness of management – Monitoring enables you to measure the response of a pasture and underlying soil to different management actions. It can also be useful for recording the effect of a change in management on pasture composition, such as the effect of resting a pasture or changing from continuous to rotational grazing.
  - » To develop a better understanding of native pastures – Pastures and soils are the basis of grazing enterprises, and they directly affect the health, productivity and profitability of the business. It is important to understand how pastures function and how management decisions affect them. Monitoring pastures encourages graziers to look more closely at the plant and soil aspects of their grazing systems.
- » Because livestock condition is different from pasture condition – Livestock condition is a poor indicator of pasture condition, because livestock can appear healthy despite degrading pastures and soils. Eventually, pasture and soil degradation will adversely affect livestock health and pasture carrying capacity. However, many graziers monitor only their livestock and neglect to monitor their pastures.



*Wallaby grass pasture following drought and a corbie grub attack.*



## MONITORING WITH FIXED-POINT PHOTOGRAPHS

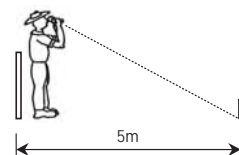
The simplest way to monitor the pasture in a paddock is to take fixed-point photographs at regular intervals, usually in spring and autumn. Fixed-point photographs are useful for showing changes in ground cover, pasture dry matter, soil erosion, and the cover of trees, shrubs and tussocks. It is recommended that two fixed-point photographs be taken at each site: a ground-cover photograph and a landscape photograph. Be sure to write the date and location of the site on the back of each photograph. It may also be useful to keep the photographs from each site in a separate album or folder.

To set up a fixed-point photograph site

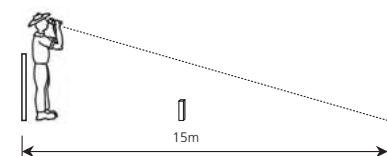
1. Choose a site that is typical of the pasture, or a site that you have a particular interest in monitoring. (You may want more than one site in a paddock.)
2. Drive a steel post into the ground at the site.
3. Drive two wooden pegs about 50 cm long into the ground, so that about 25 cm of each peg is above ground. Place the pegs in a line about 5 m and 15 m from the steel post. If possible, place the pegs in a line to the south of the post to avoid taking photographs looking into the sun.

Take the ground-cover photograph while standing with your back against the steel post, and with the 5 m peg in the centre of the viewfinder. If using a lens with a variable focal length, use a focal length of 50 mm. Record the date, paddock name and exposure number in a notebook.

Take the landscape photograph while standing with your back against the steel post, and with the 15 m peg in the centre of the viewfinder. Again, use a 50 mm focal length lens, record the date, paddock name and exposure number in a notebook as previously.



*The ground-cover photograph*



*The landscape photograph*

## Chapter 12 Monitoring Change in Native Pastures



*Litter is an important component of ground cover.*

### MONITORING PASTURE COMPOSITION

Monitoring the composition of a pasture gives more information than fixed-point photographs by recording the species present and their abundance.

Many methods can be used to monitor pasture composition. The species present may be recorded separately, e.g. key native grasses, such as kangaroo grass, or the species may be grouped into functional groups, e.g. native grasses, clovers, annual grasses, native broadleaf species and introduced broadleaf species.

The most common methods involve measuring cover. These include

- » Place a number of quadrats (minimum size 50 cm x 50 cm) randomly or at fixed points (e.g. 30) in the pasture, and estimate the cover of the species or species groups, litter and bare ground in each quadrat. Then, calculate the average cover of each component.
- » Throw a pointed stick a fixed number of times (e.g. 100) while walking through the pasture, and record the species or species group of the plant directly under the point where it lands. If no plant is present, record whether the point is over litter or bare ground. The cover of each component is the number of 'hits' expressed as a percentage (Prograze Victoria 2005).

Alternatively, if the purpose is to monitor changes in particular species or species groups, frequency (i.e. commonness of occurrence) is the best measure to use. This is best obtained using gridded quadrats (e.g. a 50 cm x 50 cm piece of weldmesh comprising 25 squares 10 cm x 10 cm). Place the quadrat randomly or at a number of fixed points (e.g. 30) in the pasture, and count the number of grid squares containing each of the species or species groups of interest. The frequency of each component is the average count expressed as a percentage.

The composition of a pasture should be monitored at least once a year, the best time being in early spring. Estimating the plant cover is easiest when the pasture has been grazed to 5–8 cm. Removing livestock from the paddock three weeks before monitoring allows the plants to flower, and makes plant identification easier. It is important to also keep records of rainfall, stock movements and other management actions, such as fertiliser application, to help make sense of any changes in pasture

#### Monitoring results

Table 7. Changes in percentage composition (% cover) over 4 years in a wallaby grass pasture monitoring site in Tasmania.

Species or species group	Date				
	Oct 2001	Nov 2002	Nov 2003	Oct 2004	Nov 2005
Kangaroo grass	5	2	1	1	1
Tussock grass	5	3	5	3	3
Wallaby grasses	35	25	30	25	20
Native lilies and broadleaf species	5	2	2	1	1
Clover	15	30	15	10	25
Annual grasses	10	20	25	30	20
Broadleaf weeds	5	10	15	15	20
Moss and lichen	5	3	2	0	0
Bare ground	15	5	5	15	10



composition. Most importantly, such records allow better and more informed decisions to be made about the pasture's management.

The decrease in native grass cover of the paddock documented in Table 7 may not have been noticeable without monitoring. If the trend continues, the pasture will become severely degraded. The figures indicate that the grazing management needs to be reviewed to prevent further degradation.

## MONITORING SOIL ATTRIBUTES

While fixed-point photographs can show changes in the surface soil condition, e.g. erosion, they give no indication of the chemical, morphological and physical changes that relate to soil health.

The key chemical attributes to monitor are soil pH and electrical conductivity. These can be measured from soil samples using pocket-type meters or laboratory analyses. Major elements, such as phosphorus, potassium and sulphur, together with soil carbon can also be monitored through laboratory analyses to show changes in soil fertility. This is particularly important when fertilisers have been applied. Measuring every 5 years would be sufficient for most situations, though for fertilised pastures more frequent measuring (e.g. every 2–3 years) would be better to ensure that soil fertility levels are not raised too quickly (see Chapter 5, 'Managing fertiliser on native pastures').



*Landscape photographs of a native pasture showing changes in the vegetation cover between January 2004 (top) and November 2004 (bottom).*

Soil morphological and physical attributes, such as consistency and structure, affect water intake, water holding capacity and rooting depth.

Measuring these attributes mostly requires specialised procedures, which are offered by some agricultural consultants. Measuring every 10 years would be sufficient to monitor the important soil morphological and physical attributes.





## Matthew Dunbabin

'Bangor', Dunalley

'In early summer 2001, we set up two pasture monitoring sites. Both sites are on predominantly native pasture. One site is a native pasture that's never been sown or fertilised. The second site is a far more productive area that's still predominantly native, but it's had some application of fertiliser and spreading of legume seeds in the past, so there's a fair mix of native and introduced species.

'We chose these sites because they're contrasting in their species composition, in the times of year they're growing, and in the way we use them.

'The initial monitoring has given us an overview of the composition of the two pastures. Now, we've got a good baseline of what's there, which we didn't have before, and we can go forward and monitor the changes over time.

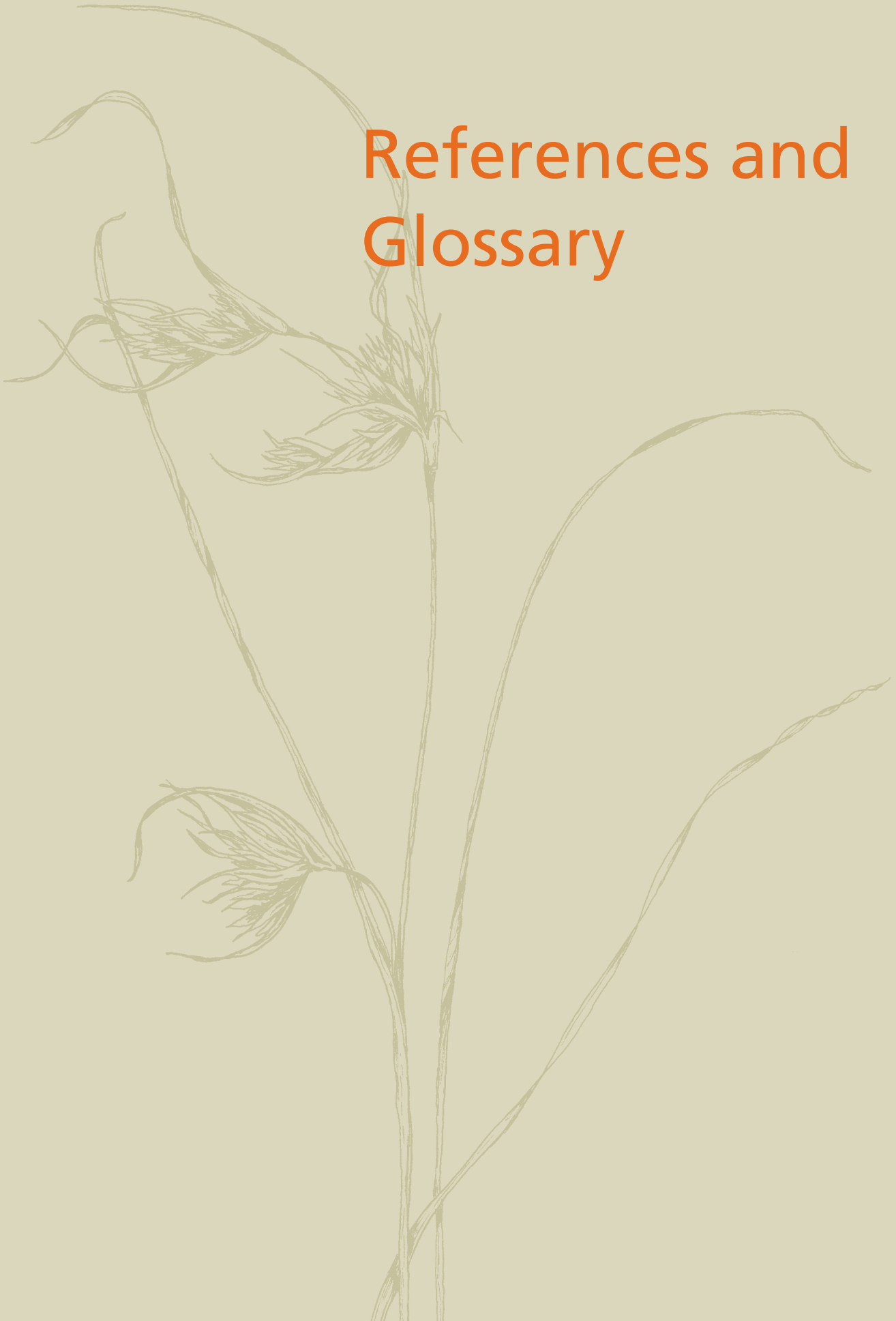
'Both pastures need to be productive and produce useful feed. We want to retain the native species present, and

possibly even improve the proportion of native species in both areas. On the more developed pasture, there's a lot of annual grasses, and the aim is to reduce the cover of those species. Whether they're replaced by native species or introduced perennials remains to be seen, but we'll try to get rid of the annual grasses.

'Monitoring these two pastures will allow us to really think about our grazing management. So, we'll try to graze and spell at times that promote the species we want, and retard the species we don't want.

'Without monitoring, we don't have an objective way of measuring whether we're heading in the right direction with our management. Once we start to get an idea of how our management is affecting these pastures, we can extrapolate the results to other areas of the property.'

# References and Glossary



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## AGENCY CONTACTS

The Department of Primary Industries and Water (DPIW) is the government agency with the primary role of managing the Tasmania's natural resources - air, land, water, plants and animals – for the benefit of all Tasmanians.

[www.dpiw.tas.gov.au](http://www.dpiw.tas.gov.au)

The Land Information System Tasmania (the LIST) is a whole of government integrated land information infrastructure with a web based delivery system. It includes spatial information such as natural resource data.

[www.thelist.tas.gov.au](http://www.thelist.tas.gov.au)

Land, Water & Wool is a national research program providing wool producers with practical tools for managing natural resources sustainably and profitably.

[www.landwaterwool.gov.au](http://www.landwaterwool.gov.au)

Tasmanian Institute of Agricultural Research (TIAR) is a joint venture between DPIW and the University of Tasmania focusing on research for Tasmanian agricultural industries.

[www.tiar.tas.edu.au](http://www.tiar.tas.edu.au)

## GLOSSARY

**Annual species** – Species whose life cycle is completed in one year: typically germination in autumn, flowering in early spring, and seed set, senescence and death in mid-late spring. Examples include annual grasses, such as rat's tail fescue, annual clovers, such as subterranean clover, and broadleaf species, such as capeweed.

**Awned seeds** – Seeds that have a stiff, often spear-like projection. Examples of species with awned seeds include native spargrass and barley grass.

**Biodiversity** – The variety of life forms, including plants, animals and micro-organisms, and the genes they contain and the ecosystems they form. Biodiversity is an essential element of a healthy, functioning ecosystem.

**Block grazing** – see Rotational grazing and Cell grazing

**Botanical composition** – The plant species present in an area of vegetation (e.g. the desirable native and exotic grasses, legumes and other broadleaf species, and the exotic weed species present in a pasture). For pastures, often, referred to as 'pasture composition' or 'species composition'.

**Broadleaf species** – A highly variable group of plants: most have broad leaves with net-like veins as opposed to the narrow leaves and parallel veins of grasses. Also called Dicots.

**Carrying capacity** – The maximum stocking rate that can be supported by a pasture without causing a deterioration in the condition of the pasture: usually measured in dry sheep equivalents per hectare (DSE/ha). The carrying capacity of a pasture is not static, but varies from season to season and year to year.

**Cell grazing** – Grazing management in which livestock are moved around a cell consisting of a large number of small paddocks of a size that allow high stocking densities to be used in each paddock for a short time. Pasture growth rates must be monitored, and grazing periods should be calculated according to the growth and recovery rate of the desirable pasture species.

**Conservation value** – A value ascribed to an area of vegetation that defines its worthiness for conservation. Areas with high conservation value would include poorly conserved, rare and threatened ecosystems, and ecosystems containing rare or threatened species. Wildlife corridors linking core habitat areas may also have a high conservation value.

**Continuous grazing** – Grazing management in which livestock remain in a paddock for a long time. The paddock may be rested for part of the year, and the stocking rate may change over time. Also called set stocking.

**Crash grazing** – see Mob stocking

**Crude protein** – The estimated protein content of stock feed obtained from laboratory analysis, expressed as a percentage of the dry matter (% DM). As plants mature, their crude protein content decreases. Values range from 3% in mature, dry material to over 30% in young, green, heavily fertilised forage.

**Cryptogams** – Plants that have no true flowers or seeds (e.g. mosses, algae, lichens and fungi). In native pastures in good condition, cryptogams cover areas where there is no other plant cover, thus protecting the soil from erosion.

**Dicots** – The abbreviation for dicotyledons, which are flowering plants that have two leaves emerging from the seed. Also called Broadleaf species, (see also Monocots).

**Digestibility** – The proportion of consumed pasture used by the animal (expressed as a percentage of the dry matter consumed). For example, if the digestibility of a pasture is 65%, the animal uses 65% of the consumed dry matter for its nutritional requirements, and the remaining 35% passes through as faeces.

**Dry matter (DM)** – The plant material in a pasture with the water removed by drying.

**Dry sheep equivalents (DSE)** – The standard unit used for estimating the feed requirements of different types of livestock. The basic unit of 1 DSE is a merino wether (45 kg live weight) maintained in store condition by an intake of feed that provides 7 Megajoules (MJ) per day of metabolisable energy.

**Ecosystem** – A biological community of interacting organisms and their physical environment (e.g. a native pasture containing a range of native and exotic plants, and supporting a variety of soil micro-organisms, insects, reptiles, birds and mammals, including sheep, on a dolerite soil on a north-facing slope in the central Midlands).

**Exotic species** – see Introduced species

**Forage value** – The overall quality of a pasture as a source of nutrition for livestock (i.e. digestibility, protein content, metabolisable energy).

**Forbs** – Non-woody plants other than grasses.

**Grassland** – Vegetation in which grasses dominate the ground cover, and the tree cover is sparse or non-existent.

**Grazing pressure** – The relationship between the number of grazing animals and the amount of forage available at a particular time, expressed as DSE per kg of pasture dry matter (DSE/kg DM).

**Ground cover** – The proportion (%) of ground surface covered by plant material, including litter. A minimum ground cover of 70% is necessary to protect the soil from wind and water erosion.

**Growing points** – Tissues within the plant that produce new cells and new plant tissue.

**Habitat** – The natural home of an organism, i.e. the place where a particular plant or animal naturally grows or lives.

**Herbage mass** – The amount of pasture expressed as kg of pasture dry matter (kg DM).

**Herbs** – Non-woody plants, including grasses, broadleaf species, sedges, rushes and lilies.

**Introduced species** – Species that were not present in Tasmania before European settlement. It includes species that have been introduced intentionally and unintentionally. Also called non-native or exotic species.

**Land capability** – The ability of land to support a particular type and intensity of use without permanent damage (e.g. crop production requiring regular tillage). Land capability is determined principally by the physical properties of the soil, slope and climate.

**Land types** – Defined by features such as topography, aspect, soil type, geology, and vegetation.

**Litter** – Dead plant material lying on the ground, unattached to plants.

**Metabolisable energy** – The energy content of stock feed that is available to the animal following digestion for maintenance (to maintain basic metabolic processes and body temperature) and for production (wool growth, weight gain, foetal growth and milk production). Metabolisable energy is expressed as megajoules per kilogram of dry matter (MJ/kg DM). Values for pasture vary from about 5 MJ/kg DM for dry material to over 12 MJ/kg DM for young, green forage.

**Mob stocking** – Grazing management in which a pasture is grazed by a large number of livestock (high animal density) for usually a short period of time followed by a long rest. Also called crash grazing.

**Monocots** – The abbreviation for monocotyledons, which are flowering plants that have one leaf emerging from the seed (e.g. grasses and lilies. (See also Dicots)

**Native species** – Species that were present in Tasmania before European settlement.

**Non-native species** – see Introduced species

**Overgrazing** – Grazing where the stocking rate exceeds the carrying capacity of the pasture. Overgrazing degrades the condition of a pasture through loss of desirable pasture species, weed invasion and/or soil erosion.

**Palatability** – The acceptability of forage to livestock.

**Pasture** – An area devoted to the production of forage for livestock in which the ground cover is dominated by herbaceous species, such as grasses and broadleaf species.

**Pasture condition** – A descriptive term that combines information on botanical composition, pasture cover, soil erosion, etc., that relate to its ability to support grazing. A native pasture in good condition would have a high native grass content (greater than 70% pasture DM) and a small amount of bare ground (less than 10%).



**Perennial species** – Species that persist for more than two growing seasons. Examples include most native grasses, such as wallaby grasses and kangaroo grass, many native broadleaf species, such as common everlasting, and many sown grasses, such as perennial ryegrass and cocksfoot.

**Recruitment** – The process of regeneration from seedlings.

**Resting** – Removing livestock from a paddock for a period of time. Also referred to as spelling.

**Riparian** – vegetation that occurs along the margins of wetlands and rivers.

**Rotational grazing** – Grazing management that involves regular periods of grazing and resting.

**Rotational resting** – see Rotational grazing

**Sagg** – The plant *Lomandra longifolia*, also called cutting rush.

**Sedges** – Grass-like plants that belong to the family Cyperaceae. They often have hard leaves and stems and their flowering parts are usually dark, rather than straw-coloured.

**Selective grazing** – The propensity of livestock to graze particular favoured plants or parts of a plant.

**Set stocking** – see Continuous grazing

**Soil seed bank** – The amount of seed stored in the soil.

**Sown pasture** – Pasture established by sowing introduced species (e.g. grasses and clovers), normally following the removal of existing vegetation by cultivation or herbicide use or both. Also referred to as introduced pasture or improved pasture.

**Sp.** – An abbreviation of species (plural spp.), which is used when the specific name (the second term in the binomial system of botanical nomenclature) is uncertain (e.g. *Austrodanthonia* sp. refers to a species belonging to the genus *Austrodanthonia* whose specific name is uncertain; *Austrodanthonia* spp. refers to several species of the same genus).

**Spelling** – see Resting

**Stocking rate** – The number of livestock on a particular area: usually expressed as dry sheep equivalents per hectare (DSE/ha).

**Time-controlled grazing** – see Rotational grazing

**Utilisation** – The proportion of pasture forage eaten by stock.

**Volunteer species** – Usually an introduced plant species that has not been deliberately sown or introduced, but has dispersed and spread by itself to different areas. Examples include annual grass weeds, broadleaf weeds and small leaf annual clovers.

**Wildflowers** – Native broadleaf plant species.

**Woodland** – An area of vegetation with trees, where the tree canopies are clearly separated. A grassy woodland has an understorey dominated by grasses.