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

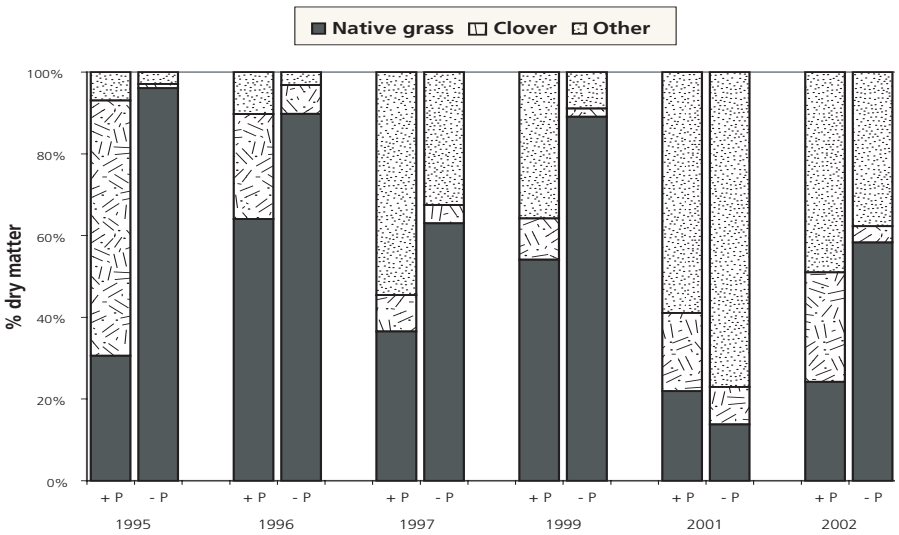


Figure 12. Bar graphs comparing the pasture composition in spring of a fertilised paddock (+P) and an unfertilised paddock (-P), from a paired-paddock trial in a wallaby grass pasture at Bothwell, Tasmania.

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.

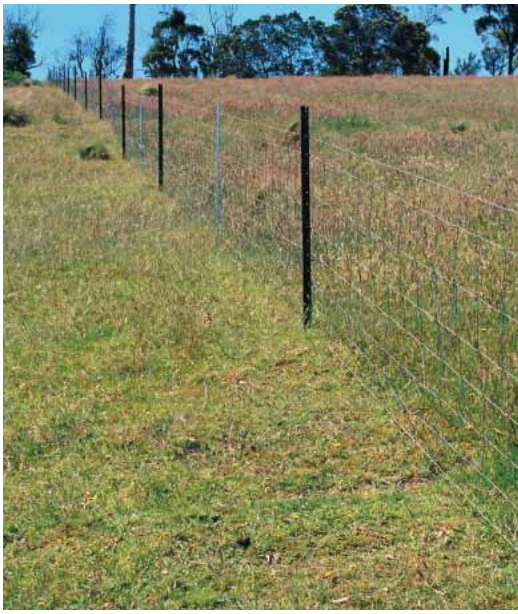
Grazing strategies to increase abundance of clover in native pastures

» Autumn – Graze heavily to remove dead plant material and control grass growth before the autumn break.

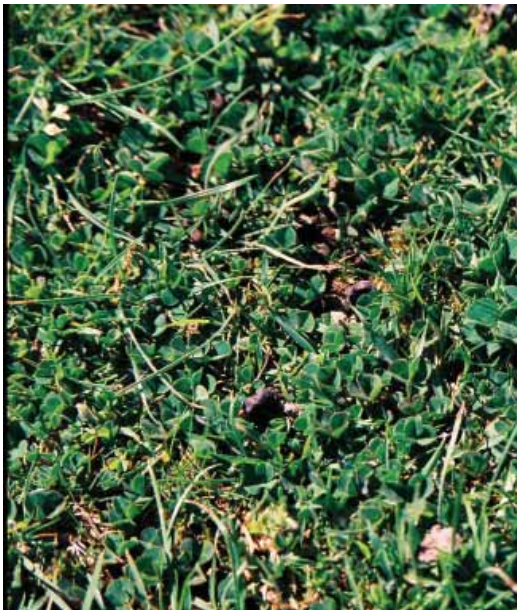
» Winter – Rest or graze lightly after the autumn break to allow clover seedlings to establish.

» 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.

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)

	Bothwell		Pawtella		Nile	
Year	Unfertilised	Fertilised	Unfertilised	Fertilised	Unfertilised	Fertilised
1994–1995	790	1,800	-[1]	-[1]	-[1]	-[1]
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	-[2]	-[2]	970	980	810	2,870
1998–1999	-[2]	-[2]	1,830	2,810	1,480	3,790
1999–2000	-[2]	-[2]	1,090	970	680	1,600

[1] *Trial not begun.*

[2] *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

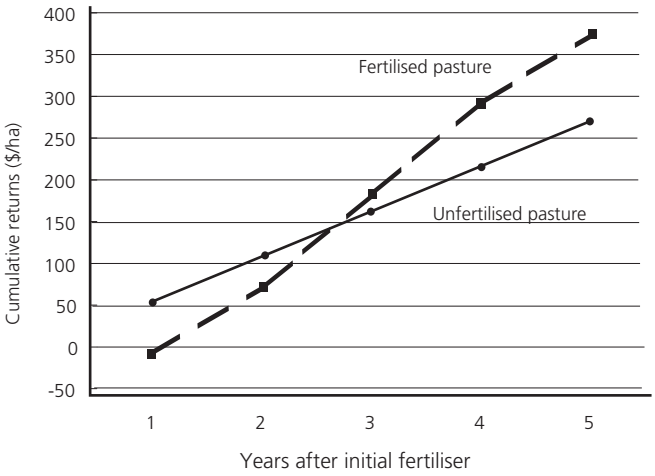


Figure 13. A comparison of the estimated financial returns from fertilised and unfertilised native pastures in Tasmania, based on an increase in stocking rate from 2.9 to 6.0 DSE, and gross margin analysis applied to a medium wool enterprise using costs and returns for 1999–2000.

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.

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.

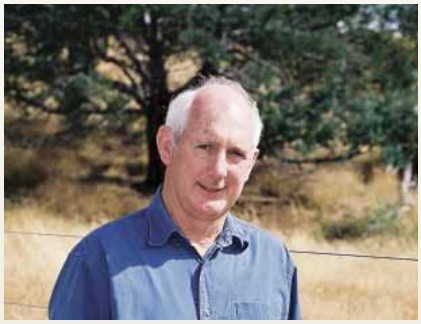
Richard Bennett

'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

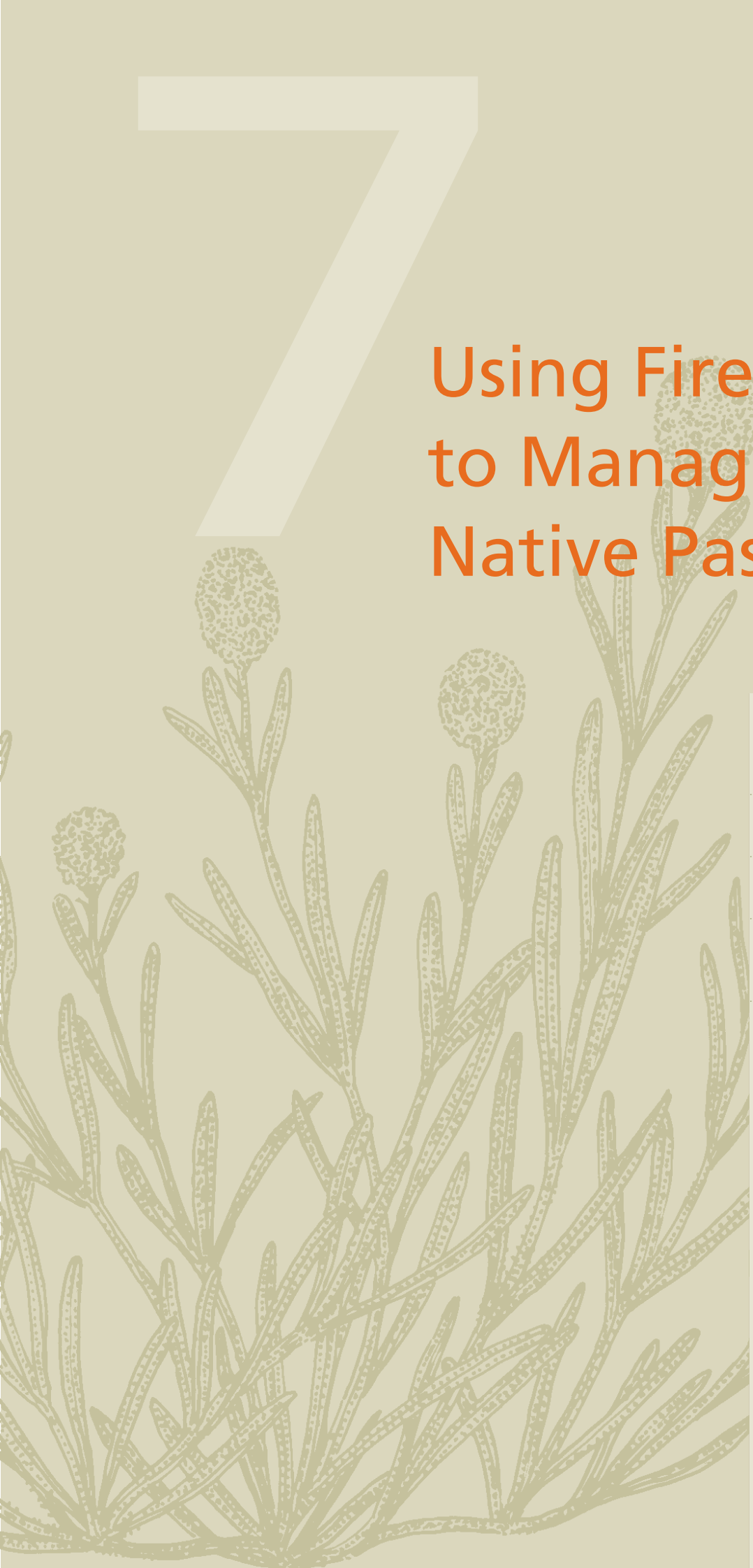


'One of the biggest problems we have on our native pastures is horehound. It grows on rocky outcrops and steep slopes. We can control it by spraying, but spraying leaves areas of bare ground for it to grow back in, and that's exactly what happens.

'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.'

7

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.

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.

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.'