



# MANAGING NATIVE GRASSLAND

a guide to management for conservation,  
production and landscape protection



## TEN TOP TIPS FOR MANAGING NATIVE GRASSLAND

- allow all native plant species to grow, flower and set seed at least every few years
- develop a sympathetic grazing, mowing and/or burning regime to prevent loss of diversity
- avoid producing windrows or clumps of grass clippings when mowing or slashing
- encourage a dense, vigorous and diverse plant community to minimise weed invasion
- avoid any unnecessary physical disturbance of the soil - e.g. ploughing, riplines or trenching
- avoid any unnecessary soil compaction by vehicles or heavy equipment
- avoid any change to the fertility of the soil - e.g. fertiliser or lime
- control self sown exotic trees and don't plant any new ones in native grassland
- keep feral animals (grazers and predators) under control or out of native grasslands
- write and follow a simple, effective management plan and monitor its progress

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*Cover - Native grassland of Snowgrass and Kangaroo Grass, sprinkled with Scaly Buttons, looking toward the Boboyan Divide, on the southern ACT/NSW border.*

*Above - Snowgrass, Kangaroo Grass and scattered Snow Gums, looking down the valley of Bobundara Creek near Nimmitabel.*

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# MANAGING NATIVE GRASSLAND

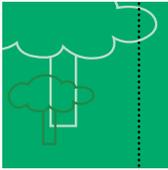
a guide to management for  
conservation, production and  
landscape protection

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July 2002

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# INTRODUCTION

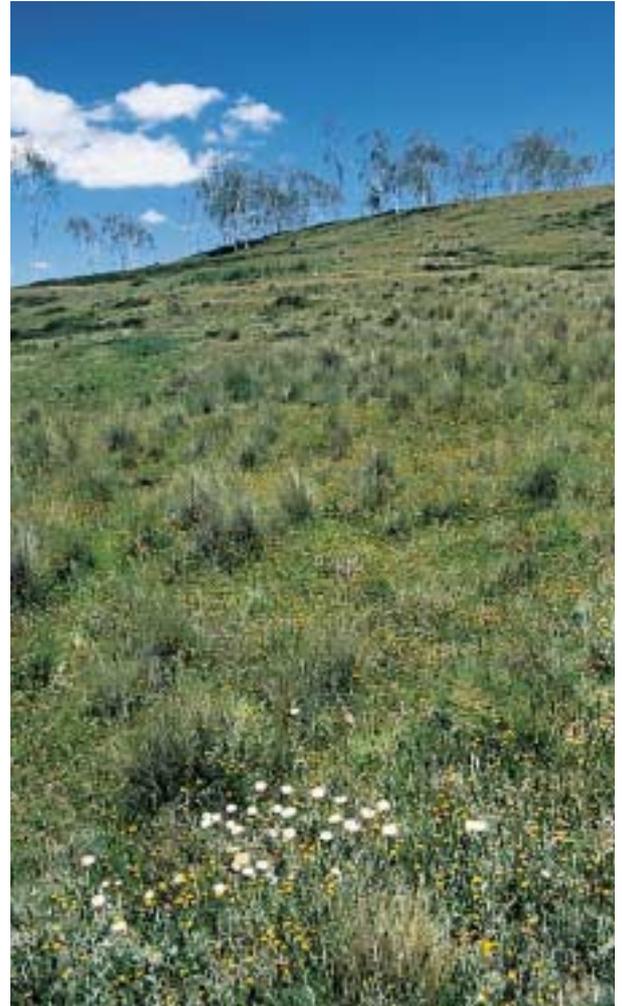


*Native Caraway is common in grasslands around Adaminaby.*

The aim of this booklet is to provide background information, guidance and encouragement to managers of native grasslands. Considerable variety is found among the native grasslands of temperate south-eastern Australia. However, many of the ecological concepts and management requirements are common to all. This booklet is based on experience of the NSW Southern Tablelands, but is written in general terms so that the information might be useful throughout the NSW Tablelands and beyond. Much of the information should also be useful to grassy woodland managers throughout and beyond the Tablelands.

Many thousands of hectares of native grassland with significant conservation value remains on both private and public rural land on the Tablelands. This vegetation remains largely because it has not been replaced with sown pastures or crops, nor inadvertently modified by continuous or heavy grazing, soil fertility change or introduction of exotic pasture plants. In recent years these grasslands have become the envy of many people in other parts of temperate Australia where native grassland has been almost completely lost.

Native grasslands in this part of Australia have only recently received significant community and scientific interest. Our understanding of their composition and ecology is therefore not as detailed as that of more treed vegetation communities. However, research and field management experience in recent years has yielded enough information to allow the development of some useful general management recommendations.



*Hoary Sunray flowering among Snowgrass and Kangaroo Grass with Weeping Snow Gums scattered on the rise. Weeping Snow Gums are a feature of the shale derived soils to the east of Adaminaby.*

*Opposite page, top: Grass Triggerplant and Kangaroo Grass at Round Plain near Berridale.*

*Opposite page, middle: This native buttercup forms dense mats in damp depressions within grasslands.*

*Opposite page, bottom: A tiny green spider on a Kangaroo Grass stalk gives some insight into the smaller grassland fauna.*

Native grasslands hold great value for conservation, production and landscape health and function. This booklet is intended to encourage and assist management of the native grasslands remaining in our care.

# WHAT IS A NATIVE GRASSLAND?

## Vegetation structure ►

Native grasslands are vegetation communities in which grass plants are structurally dominant because the groundcover of woody plants (trees and shrubs) is less than 10%. A common misconception is that grasslands are completely treeless; however, grasslands often contain scattered trees. When the groundcover of trees exceeds 10% the community is called a grassy woodland. The botanical composition of the grassy understorey in a grassy woodland is very similar to a native grassland because the majority of the non-woody plants (herbs) grow in both grassland and woodland. In practice, the distinction between grassland and woodland is somewhat arbitrary and these communities intergrade, forming a vegetation mosaic throughout the Tablelands landscape. The distribution and density of trees in the landscape today is a reflection of natural processes, active clearing and recolonisation.

## More than just grass ►

In addition to a wide variety of grasses, native grasslands in their natural state contain a high diversity of other herbs including sedges, rushes, orchids, lilies and forbs (broad-leaved herbs). About 700 species of native herbs have been identified in the grasslands of South-Eastern Australia, the majority of which are not grasses. A typical grassland in good condition is comprised of a wide variety of grass species and a much wider variety of non-grass herbs.

## More than just plants ►

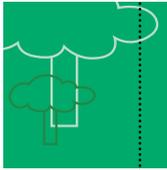
Native grassland communities include a large number of other organisms too. Above ground you might see a wide variety of insects, spiders, frogs, reptiles, birds and mammals. Lichens and fungi live down among the plants, on the surface and into the soil. Below ground there is a huge array of soil organisms including worms, beetles, ants, and micro-organisms. All these organisms play important roles in the function, health and stability of native grasslands.

## Dynamic and changeable

The appearance of native grasslands can change dramatically during the course of a year. The herbage mass can fluctuate substantially as fluctuations in soil moisture and temperature,



growth and grazing, reproduction and fire each take their course. The grassland can change colour and texture from the new green growth of spring, through the many colours of the flowering season, to the red-browns and straw colours of summer and autumn. Many of the smaller intertussock plants are obvious only during the growing season and while flowering; their above ground parts dying-off after flowering and re-appearing only in the next growing season. For these reasons it can be difficult to recognise or appreciate the quality or beauty of a native grassland.



# WHY DO NATIVE GRASSLANDS NEED CONSERVATION ?



*Native Flax is an uncommon species in the Monaro region, this one is at Black Lake near Bombala.*

## Conservation value

The contribution or value of an area of native grassland to the long term conservation of natural temperate grasslands is known as its conservation value. Conservation value is determined by a number of qualities including: species composition; species richness (number of species); presence of threatened, rare or regionally uncommon species; the presence, species and density of weeds; the size, shape and location of the area; and other aspects of vegetation and landscape condition and health.

## Pastoral value

Native grasslands today vary considerably in their condition. Some are highly species rich, almost free of weeds and probably closely resemble their original state. A much larger area of native grassland is more modified, often dominated by one species of native grass, with a much lower diversity of other native herb species and often including a significant population of weeds. In some areas such modified grasslands are the only remaining native grasslands. Much of this serves as valuable and productive native pasture.

However, it also offers great value to conservation, enhancing the stability, function and aesthetics of the landscape, which could all be improved with careful management.

## Loss, fragmentation and diminishing quality

Native grasslands once occupied large expanses of south-eastern Australia. Because they were relatively or completely clear of trees they were very attractive for pastoral settlement and development. The land became divided into properties and paddocks by fencing and roads, and the vegetation was subject to new management, which often differed from paddock to paddock. This resulted in changes to the species composition of much of the area of native grassland and isolation of the remainder into fragments.

The majority of the original grassland area is now occupied by agricultural grassland with a much lower plant species diversity, a lower diversity and reduced population of native fauna, many exotic agricultural plants and weeds, and often less groundcover and soil stability. Relatively unmodified native grasslands now cover only a fraction of their original area, and many remnants are very small and highly vulnerable to change.



*Chamomile Sunray and the threatened Monaro Golden Daisy in a short open structured grassland on shale derived soil near Adaminaby.*

## Habitat for fauna

Native grassland communities provide shelter and food for a wide variety of animals. Many of the smaller mammals such as bandicoots, bettongs, quolls, marsupial mice and the White-footed Rabbit Rat, are now either missing from or very rare in the native grasslands of south-eastern Australia. Even kangaroos, wallabies and wombats have often been relegated to other parts of the landscape. Several other species of animals including insects and reptiles are now threatened with extinction because of the dramatic reduction in the area and quality of their habitat.

## Harbours of biodiversity

The diversity of species, and genetic variability both between and within species is known as biodiversity. Conservation of biodiversity is widely recognised as one of the most important aspects of nature conservation and is one of the primary objectives of many government conservation programs. Native grassland remnants harbour many hundreds of species that have largely disappeared from agricultural grasslands. A number of these species are now either locally or nationally threatened and a great many more have become quite uncommon within the region.

### Self-supporting systems

Native grasslands conserve species and biodiversity in relatively intact and naturally functioning communities. This is both the most effective and the most appropriate form of conservation as the species within the community interact to provide the conditions that support each of them with a minimum of management effort and cost. It also conserves the ecological processes that have led to their evolution and allows for evolutionary processes to continue.

### Genetic reservoirs and corridors

Good grassland remnants provide us with living genetic 'reservoirs' from which we can draw material for a number of worthwhile purposes. Harvesting of seed can help us to reintroduce many native plant species to areas from which they have disappeared. This might be extremely useful in the case of threatened or regionally uncommon species. We may also be able to reintroduce some of the threatened or regionally uncommon animal species to new areas if we protect and enhance remaining areas of suitable habitat.

Even those native grasslands with a relatively low species diversity but retaining native grass dominance are valuable, especially if they are relatively free of weeds. These areas often act as buffers around native grassland of higher diversity and corridors for the continuing movement of genetic material.

### Unexplored potential

Many of the hundreds of plant species in our native grasslands may offer significant value for pastoral use and in breeding crop plants. Some may have medicinal value, since most medicines come from plant sources. Many of our grassland plants are attractive and they are all hardy and adapted to local conditions, making them potentially valuable in native gardening and landscaping, and particularly for the burgeoning cut flower industry. The agricultural, horticultural and medicinal potential of most of the native grassland plants is largely unexplored.

### Opportunities to learn

Native grassland remnants also provide us with the opportunity to study and learn more about their composition, function, environmental importance and management requirements.

### Recreation and enjoyment

The remaining native grassland areas provide examples of the landscape appearance, vegetation structure and composition prior to European settlement. They are a valuable feature for the enjoyment, satisfaction and education of local communities and visitors alike. Well managed native grassland areas offer real potential for tourism, just as the display of alpine wildflowers is enjoyed in the mountains each summer.

### Wider community expectations

In addition to these biological and social imperatives for conserving native grasslands, land managers are now obliged under various state and federal laws, to manage native vegetation and plant and animal species responsibly and sustainably on behalf of the community.



*Above: Showy Copper-wire Daisies at Round Plain cemetery near Berridale. Many rural cemeteries retain good examples of native grassland.*

*Right: Antrorse Geranium is also common in the Round Plain cemetery.*





# WHAT THREATENS NATIVE GRASSLANDS ?

Native grasslands were established and maintained by natural conditions and processes. Soils, temperature and rainfall regimes, interactions between plants, grazing and digging animals, fire and Aboriginal activity all helped to shape the structure and species composition of native grasslands. Prevention of the establishment of trees and shrubs, recycling of organic matter and the creation of openings in the sward for recruitment of new plants and growth were all necessary for maintenance of these grasslands. Some of these conditions and processes have changed with European settlement and management, causing changes in the area, structure, species composition, diversity and function of native grasslands. Conservation of native grasslands will therefore require active management to reinstate some of these natural conditions and processes.

Where native grasslands have not been completely removed, the principal mechanisms of change since European settlement have been alteration of the grazing regime, from sporadic grazing by native herbivores to more constant and selective grazing by domestic livestock, and the complete alteration or removal of the fire regime. Threats are outlined below.

## **Grazing by livestock**

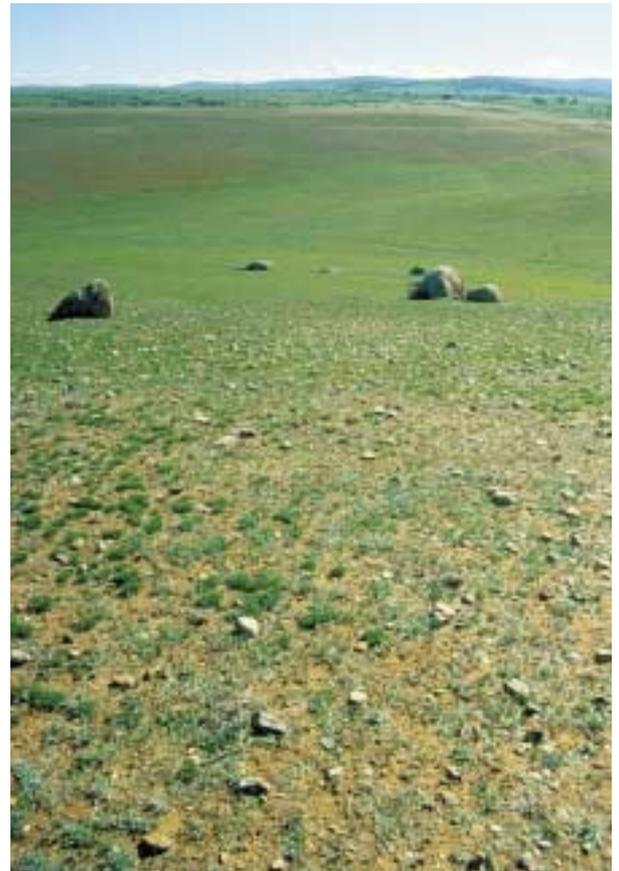
In grazed areas plants are defoliated mainly by grazing domestic livestock. All native grassland plants can withstand some degree of defoliation, but species differ in their ability to recover from repeated or heavy defoliation. All plants need to be allowed periods in which to grow, flower, produce seed, and to recruit new individuals into the sward, in order to maintain their populations. Therefore, the timing and duration of grazing events, in relation to the cycles of growth and reproduction, are crucial to the success of individual species and the native grassland community as a whole.

Grazing animals differ in their diet selection and grazing methods. Under organised agriculture, the intensity of grazing has increased in the understandable pursuit of production. The intensity of grazing at the individual species level has probably changed even more because domestic livestock have a stronger preference for more succulent species and plant parts.

Unfortunately, this has led to the depletion or removal of many native plant species and modification of habitat for native fauna across most of our grassy landscapes. A single grazing event can substantially modify a grassland's structure in the short-term. Structure has an important influence on the community's composition, function and habitat value, all of which are likely to change if the grassland's structure is highly altered for extended periods.

## **Grazing by feral animals**

Another source of defoliation is uncontrolled populations of feral animals, particularly rabbits. The diet selection of rabbits also puts more pressure on those smaller, more succulent species that are less tolerant of regular or heavy grazing. It is likely that a significant proportion of the change in native grasslands has been the result of grazing by rabbits, rather than by domestic livestock.



*Heavy grazing over long periods can dramatically change grassland composition. In this photo all the grasses have been removed from the foreground - only bare ground and two species of forbs remain.*

## Mowing and slashing

Mowing and slashing are another form of defoliation used to manage herbage mass in some small native grassland areas. Like grazing, the main threat of mowing to native grasslands is that it can prevent flowering and seed production, by occurring too frequently or at the wrong times. Mowing and slashing equipment can also bring weed seed into native grassland from another site. Some of the most troublesome perennial grass weeds, such as African Lovegrass and Chilean Needlegrass have been seriously spread in some areas through the regular movement of mowing equipment.

## Fire

Fire was a fundamental influence in shaping and maintaining many Australian vegetation communities. Removal of fire or substantially altered fire regimes has caused significant change to the structure and composition of many vegetation communities since European settlement. Fire exerts its influence principally by defoliation, but it also affects some plants and seed through the production of heat and smoke. The timing of fire in relation to the life cycles of plants, the intensity and the frequency of fires, all have a strong influence on the long term results of a fire regime. The primary threats posed to native grasslands by fire are that the grassland is burnt too frequently, too hot or at the wrong time in the plants' life cycles, and that the whole grassland is burnt at one time, leaving no escape for native fauna. In the absence of other adequate defoliation, fire can also be too infrequent, allowing native grassland to become overgrown. Interactions between fire and vegetation are complex and it is not yet clear how we might incorporate fire into the management of native grasslands, particularly in smaller areas where off-site spread is a significant danger.



*St John's Wort on the Old Cooma Common Grassland Reserve just outside Cooma. St John's Wort has become a serious problem in this and many other grasslands.*

## Weeds

Another major mechanism of change has been the invasion of grasslands by weeds. Weeds can become established in native grasslands through introduction of weed seed and physical disturbance of the soil which encourages germination and removes competition for growth.

Many exotic plants, particularly annual and biennial herbs, are widespread though of relatively little economic or environmental concern. However, some have become particularly troublesome by causing loss to agriculture and conservation through depressed production, high control costs, and by invading and dominating native vegetation. A variety of large, perennial and highly invasive weed species such as Serrated Tussock, Chilean Needlegrass, African Lovegrass and St John's Wort, are of particular concern as they have invaded and now dominate large areas, and once established are difficult and expensive to control.



*Above: An example of the influence of management on native grassland composition. The dominance has been dramatically shifted to Snow Grass on the right and Tall Speargrass on the left, by grazing management and cultivation, respectively. This photo was taken only a few kilometres from the one on the opposite page on the same soil type.*

*Below: Fairies Aprons flowering in a periodically wet area next to Ginninderra Creek. Wet areas like this are highly vulnerable to pugging by livestock and changes in soil drainage patterns.*



### **Soil disturbance**

Physical disturbance of the soil through cultivation, ripping burrows, laying pipes or cables, fencing, tree clearing or earthworks for water storage or diversion, removes the existing vegetation and exposes freshly turned soil providing a favourable environment for weeds to establish and compete.

### **Soil fertility change**

Changes in soil fertility can alter the competitive relationships between plants to the point that the species composition of the community changes. Fertility can be affected by the application or drift of soil ameliorants (e.g. superphosphate, gypsum, lime), depletion of organic matter through excessive defoliation, compaction, physical disturbance and alteration of the soil flora and fauna (e.g. fungi, ants, worms, beetles).

### **Altered drainage**

Soil moisture is a major determinant of plant community structure and composition. Soil moisture can be altered by changes to local drainage patterns caused by the construction of dams, roads and other earthworks. Changes in the density and structure of soils through compaction, and change in the organic matter content can also change their water permeability and retention. Each of these kinds of change to a soil's moisture regime can cause changes to the species composition of a native grassland.

### **Traffic and trampling**

Frequent traffic will wear tracks in native grassland because many plant species cannot survive the direct trampling or the associated soil compaction. Light and well dispersed traffic is unlikely to cause noticeable change, but regular traffic concentrated along the same route by vehicles, livestock and even people, will result in the death of plants, leaving bare ground which is vulnerable to erosion and to weed colonisation.

### **Tree planting**

The relative or complete treelessness of a native grassland is important in its ecology. The introduction of heavy shade will give a competitive advantage to more shade tolerant species. Leaf litter from trees, especially exotic species, can significantly effect soil fertility. The needles of exotic pine trees for instance, increase soil acidity and physically blanket the ground. Trees also attract animals and birds, which are vectors of weed seeds, and their droppings increase the fertility of the soil under trees. Planting exotic trees in a native grassland is likely to change its structure and composition. Natural recruitment of exotic trees (e.g. pine wildings) from nearby adult trees will lead to the same changes if this recruitment is not controlled.

### **Herbicide use**

Application of herbicides for weed control within a grassland or spray drift from neighbouring areas could inadvertently kill many native species. Little is yet known about the tolerance of most native herb species, and small native animals, to herbicides.

### **Stockpiling and dumping**

Stockpiling, dumping and spreading of soil or gravel in a native grassland will smother plants and create bare areas for weed recruitment. This has occurred on many native grassland areas on road verges and other public land sites causing the loss of native grassland from those areas. In addition to smothering plants, soil or gravel introduced from another site is also likely to introduce weed seed into native grasslands.

### **Seed collection and introduction**

Much interest has emerged recently, in the collection of wild native plant seed, for propagation and revegetation work. This is an essential part of harnessing the potential of native plants for conservation, revegetation, agriculture and horticulture. However, harvesting seed without considering the recruitment requirements of the source community poses a threat to some communities and species. Equally, introducing plants or seed of the same species from another area carries a risk of introducing incompatible genetic material that could harm the existing population.

### **Threats to native fauna**

To provide suitable habitat for fauna, native grasslands need to provide both shelter from the elements and predators, and food. Shelter and food are enhanced by the diversity of the structure and species within the grassland. Any management action, or lack of management, that simplifies the structure or composition of native grassland will reduce its value as habitat for native fauna.



*A travelling stock reserve south of Cooma with Blue Devils flowering among the Kangaroo Grass and Snow Grass.*



# WHY MANAGE NATIVE GRASSLANDS ?



The perennial grasses in native grasslands form the structural backbone of the community yet this structure can fluctuate dramatically with the seasons and in response to soil moisture, temperature, grazing, fire, frost and management by humans. Though most of the plants in the community are perennials, many of them can reach reproductive maturity in their first growing season, and produce seed and recruit new plants readily under favourable conditions. These features allow the community to produce new plants readily if necessary. Because native grasslands can show such a high rate of turn-over, of both biomass and individual plants, disturbance to either the biomass or plant population can change the structure or composition dramatically in a short period. This means that native grasslands are highly dynamic by comparison with other vegetation communities in which a higher proportion of biomass is 'tied up' in woody tissue which can stand for many years.

Because the natural processes and cultural practices that influenced native grasslands before European settlement have been so altered, active management is now essential to maintain and manipulate their structure and composition and minimise the main threats to their conservation.

The overarching objectives of native grassland conservation are to:

- retain stable, resilient and productive vegetation for landscape health
- conserve as much biodiversity as possible, including diversity of native grasslands, diversity of species and diversity within species
- retain examples of the original vegetation for enjoyment, recreation and tourism

To achieve these objectives, we need to retain a significant number of grasslands in a variety of locations and environments, each with as many species as possible and each large enough to function as a viable self sustaining community. In the longer term, with good management, we should also be able to improve the quality of these native grasslands, in terms of their species composition, species richness, weediness, animal populations and in turn their productivity and ecological function.



*Above: A native buttercup flowering in a damp depression on Middlingbank Peninsula where a local Landcare project is conserving the grassland with improved long term management.*

*Left, top: The threatened Creeping Hop Bush flowering on a shale derived soil between Cooma and Dry Plains.*

*Left, second: Milkmaids are an uncommon lily species shown here at Mulligan's Flat, Canberra Nature Park.*

*Left, third: Tiger Orchid on O'Connor Ridge, Canberra Nature Park.*

*Left, bottom: Blue Devils in Ravensworth Travelling Stock Reserve south of Cooma.*

# MANAGEMENT CONSIDERATIONS

## Defoliation management (grazing, mowing and burning)

Some form of defoliation is essential to maintaining the structure and botanical composition of most native grasslands. Without regular removal of some herbage, excess grass will accumulate and die, and can inhibit the growth of many plant species in the sward. Before the introduction of domestic livestock and rabbits, and the displacement of the many species of native fauna, this defoliation was performed by the native animals, including both large and small mammals and grasshoppers and other insects, and by fire, both naturally occurring and those lit by Aboriginals.

The majority of the non-grass plant species in grasslands grow in the intertussock spaces. When the grass canopy closes over these spaces, it shades and out competes these smaller plants, and they can be lost from the sward. Therefore, inadequate defoliation can be as damaging to species richness as excessive defoliation. It can also inhibit the major grass species. For example Kangaroo Grass, one of the most commonly dominant native perennial grasses, is known to become less vigorous and even die when heavy growth has accumulated after a number of years without defoliation.

Defoliation is only necessary to prevent the grassland becoming overgrown by the dominant grasses. The frequency and degree to which it is necessary depends on the inherent productivity or growth rate of the grassland. On more productive areas it will require more frequent or heavier defoliation to maintain open intertussock spaces. On shallow, stony and infertile soils, defoliation management should be much less frequent and intense.

### Grazing management

Grazing herbivores, whether native or exotic, have a profound influence on the structure, species composition and species richness of a grassland. Until European settlement, native grasslands had evolved under and reflected the diet selection and grazing pressure exerted by the native fauna. Since European settlement commercial grazing by domestic livestock has been and is likely to continue to be, the primary use and the main method of defoliation in native grasslands. Conservation management of grazed native

grasslands will require a good understanding of defoliation requirements and how we can best satisfy these requirements with domestic livestock.

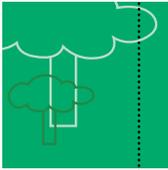
Several factors need to be considered in designing a suitable grazing management regime. The timing, selectivity, intensity and duration of grazing each influence its impact on the individual plants and the whole community. Good management of the grazing pressure on a grassland will require sound stock proof fencing.

### Timing

Native grassland must be allowed to grow freely enough to replenish root reserves, flower and set seed, or it will inevitably deteriorate. Plant species differ in their ability to withstand repeated defoliation. The taller and more succulent plant species, such as orchids and lilies, are even more vulnerable to grazing which is probably why they have been lost from a large proportion of native grasslands. Native grasslands should therefore be grazed very lightly (e.g. no more than one sheep per hectare) or preferably completely rested, during flowering and seed production. Most plants in our temperate grasslands do this from late spring to early summer.



*Native Buttercups flower on the Adaminaby golf course, managed under a community based Trust, using a combination of grazing, slashing and burning.*



### *Selectivity*

All grazing animals have preferences for grazing some plant species and parts, over others. For instance, sheep tend to graze younger growth and more succulent species than do cattle, while goats tend to graze drier and rougher herbs and browse on shrubs. Native animals have different grazing habits again. These differences in diet selection have changed the species composition of native grasslands because the relative grazing pressure on the various species has changed markedly with the introduction of exotic animals. Grazing animals are most selective under continuous light set-stocking. This effect can be reduced by increasing the stocking rate and reducing the time a mob of stock is in a particular paddock. However, higher stocking rates and more frequent stock movements require more intensive management, and reduce the room for error, so this should only be undertaken with great care.

### *Intensity and duration*

A fundamental objective of commercial grazing is to maximise the harvest of herbage by animals in order to maximise production. However, maximising the harvest of pasture in the short to medium term, will lead to a shorter and more even grassland structure. A taller and more diverse structure will allow plants to recover from grazing more quickly, help resist weed invasion by maintaining higher groundcover and competition, and provide food and shelter for a wider variety of native fauna. When herbage quantity or quality become too low to maintain livestock condition, the stock should be moved, rather than being supplementarily fed, to protect the grassland from over-grazing and excessive trampling.



## **Mowing and slashing management**

### *Timing, height and frequency*

Mowing and slashing are used as the main method of defoliation in many small native grassland areas where grazing is not wanted. Timing, height and frequency of mowing influence native grassland species composition and structure and potential for weed invasion in the same ways as grazing and burning. A mowing or slashing regime should allow for periods of good growth between mowings and should allow the grassland to flower and set seed at least every few years.

### *Grass clippings*

Management of the grass clippings produced by mowing or slashing in native grassland is an important consideration. Mowing and slashing equipment often leave windrows or clumps of grass clippings on the grassland. These windrows and clumps of clippings can sit for months, shading and smothering the plants below and sometimes killing them. The death of these plants leaves the soil bare and vulnerable to both erosion and weed invasion. The decomposition of the grass clippings and dead plants also releases nutrients into the soil creating an even more favourable environment for weed growth.

Production of windrows or clumps of clippings can be avoided by using flail type mowers which distribute the grass clippings more thinly and evenly. Where flail type mowers are not available or very heavy growth is being cut, the clippings could either be caught in a catcher or raked and removed from the site.

### *Weed seed spread*

Weed seed is often spread from one site to another by mowing machinery. To avoid introducing weed seed from another site, mowing equipment should be reasonably clean of clippings and seed before use in a native grassland, particularly if this equipment has been used in an area with serious weeds.

*Native grassland managed by mowing - Bibbenluke cemetery near Bombala.*

## Fire management

Fire may be a powerful tool in the management of native grasslands, either in the absence of, or in conjunction with grazing or mowing. Fires can be lit either by people or natural causes, both of which occurred before European settlement and both are possibilities under modern day grassland management.

### *Potential advantages*

Fire may have some advantages over other forms of defoliation. All the native plant species in a native grassland can accommodate fire, but many of the exotic weed species may not have evolved in such an environment. It is possible that a fire regime which is sympathetic to the native species but inhospitable to the weeds may help in reducing the weediness of many native grasslands. At the very least, fire has the advantages of not introducing weed seed, as both livestock and mowing equipment can, and being less selective than livestock in the species it burns.

### *Timing*

The timing of fire should accommodate the need of a native grassland to flower and produce seed. Native grassland could be burnt between the end of seed set (mid to late summer) until the plants begin to produce flowers again in spring. This will also often be the only time the grassland has enough dry herbage to carry a fire and not enough green herbage to preclude a fire.

### *Intensity*

Hot weather, high wind, lots of dry grass and low soil moisture all increase the risk of a grass fire being too hot. Under these conditions the heat of the fire can kill plants and their seeds in the soil and can even burn down into the soil, reducing the soil organic matter and changing the soil structure. Fires should only be lit when the soil is reasonably moist and the temperature and wind conditions will allow the fire to be kept under control. This timing will also help managers comply with fire regulations and reduce the risk of wildfires.

### *Frequency*

The frequency of burning poses the same threat to native grassland as does grazing or mowing too frequently. Fire will only be necessary when a grassland becomes overgrown by the dominant grasses. On more productive areas and in the absence of grazing or mowing, this may be once every few years. In areas with shallower or less fertile soil or lower rainfall, burning may never or only occasionally be necessary.

## *Patch burning*

Fire can threaten the small native fauna within native grassland. One of the most important considerations when using fire as a grassland management tool is to use patch burning, rather than burning the whole grassland area at once. Patch burning involves burning only in patches, leaving substantial areas unburnt to act as fire refuges for small fauna. In grasslands where burning is used regularly as one of the main methods of defoliation, a pattern of rotation should be used, in which one or more discrete patches is burnt on each occasion. The next burn should be in different patches, again leaving good refuge for small fauna. By using a pattern of patch burning, the whole grassland area might be burnt over a number of years without a large proportion of the area being burnt in any one year.

## *Fire breaks*

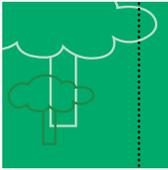
If the accidental spread of a fire into or from a native grassland is felt to be a real risk, a firebreak could be mown or slashed around its perimeter - it should never be ploughed or sprayed. Ploughing or spraying a fire break will remove competition by native plants and encourage germination of weeds, creating a strip of weedy vegetation right at the edge of the grassland.

## **Defoliation management in summary**

- in most grasslands, herbage mass must be managed by grazing, mowing or burning
- timing, frequency, degree and selectivity of defoliation must be managed to suit the grassland
- allow grassland to accumulate substantial growth between defoliation events
- allow all native plant species to flower, set seed and recruit new individuals
- avoid grazing grassland or graze only very lightly from the onset of flowering until seed set
- destock grassland when feed quantity or quality become inadequate for livestock maintenance
- avoid mowing or burning grassland from the onset of flowering until seed set
- avoid producing windrows or clumps of grass clippings when mowing or slashing
- burn grassland only when soil moisture, herbage mass, weather and fire regulations allow
- burn only in patches, burning a different patch each time
- maintain fences in sound stock proof condition



*Lobe-seed Daisy at Bibbenluke cemetery near Bombala*



## Weed management

A large number and variety of weed species are now found in native grasslands. The majority are annual or biennial grasses or forbs and are not particularly troublesome as long as their populations are kept low. These types of weeds are nearly impossible to completely remove because they can germinate, develop and set seed quickly and the soil already harbours large numbers of their seeds. The best way to keep their populations low is to maintain a dense groundcover of native plants, particularly during late autumn and winter when most weed species are germinating and establishing.

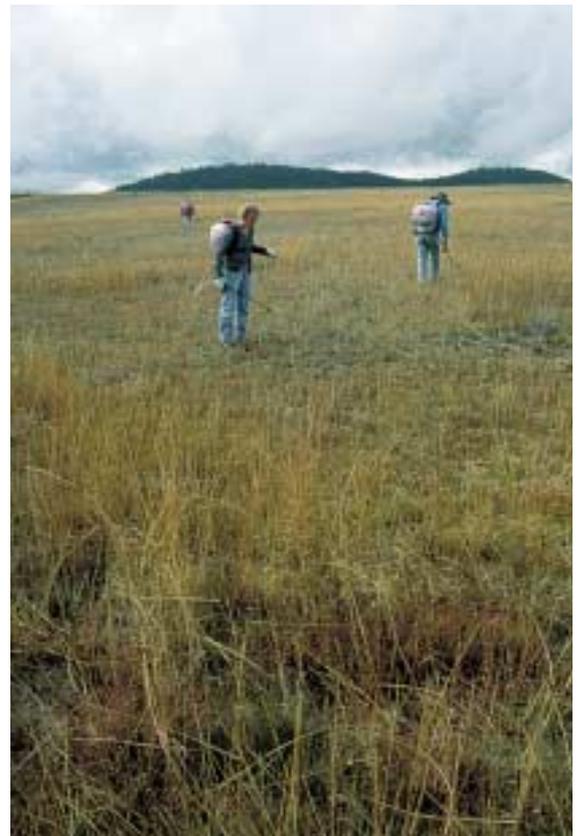
### Common perennial weeds

The perennial weeds are usually more troublesome, particularly when their populations become high. These weeds are usually larger plants which can physically dominate a community, but in some ways they are more easily managed because their populations grow more slowly. They include several species of large tussocky grasses, some exotic shrubs and some invasive exotic trees. Serrated Tussock (*Nassella trichotoma*), Chilean Needle Grass (*Nassella neesiana*) and African Lovegrass (*Eragrostis curvula*) can invade and dominate disturbed native grassland, as has already occurred over substantial areas. The two *Nassella* species have been listed among the 20 Weeds of National Significance. Two other exotic perennial grasses, Yorkshire Fog (*Holcus lanatus*) and Sweet Vernal Grass (*Anthoxanthum odoratum*) are common in wetter areas and frequently colonise and dominate in damp positions. St Johns Wort (*Hypericum perforatum*) is an exotic perennial forb gaining a strong foothold on the Tablelands and should be removed from grassy vegetation before it becomes well established. Exotic shrubs such as Sweet Briar (*Rubus rubiginosa*) and Hawthorn (*Crataegus monogyna*) can be quite invasive over long periods, but are readily removed from small areas. All these perennial weed species are controllable with early recognition of the problem and diligent action before their populations become too dense.

*Volunteers spot spraying African Lovegrass in native grassland on private land near Bredbo.*

## Weed seed introduction

Weeds can be introduced to native grasslands through a variety of processes beyond our control such as wind, water and animal movement. Weeds can also be introduced to native grassland by humans through any of several mechanisms including the movement of livestock, horses, vehicles or machinery, and the introduction of organic material (such as hay), soil or gravel. Ideally, livestock and horses should be quarantined in weed free native pasture or yards before being moved into native grassland. Vehicles entering grassland for management purposes should be as free as possible from weed seed. Machinery being used for weed spraying, earthworks or other purposes should be cleaned of weed material before entering native grassland. Supplementary feeding of livestock in grassland is likely to introduce weed seed in grain and particularly hay. Introduction of organic material, soil or gravel from outside a grassland should be avoided. Vehicular traffic, either for management purposes or visitation, should be limited to what is reasonably necessary, to avoid the spread of weed seed. On public land sites this might involve erecting fences or other barriers to prevent access and signs to highlight the value of the area.





### Control methods

Although conventional pasture and weed management has tended to rely heavily on the use of herbicides, there are a number of other methods which can be effective, either on their own or in conjunction with other methods and with herbicides. Strategic use of grazing, mowing or burning can be used to reduce seed set by weed species and favour growth of preferred native species. Encouraging and maintaining a dense and vigorous groundcover of native plants and litter is the best and cheapest method of resisting weed establishment in native grasslands. A combination of several of these techniques is likely to be more effective than any of one method on its own.

*Volunteers working to control Hawthorn on the newly established Old Cooma Common Grassland Reserve.*

### Weed management in summary

- maintain high groundcover, especially during autumn and winter to resist weed establishment
- quarantine livestock and horses in a weed free area before moving them onto native grassland
- do not supplementarily feed (hay or grain) livestock in native grassland
- do not introduce soil or gravel (e.g. stockpile, dump or spread ) from outside the grassland area
- ensure vehicles and machinery are reasonably clean of weed seed before entering native grassland
- control perennial weed species by spot spraying before populations become dense
- encourage a dense, vigorous and diverse plant community to minimise weed invasion



## Soil management

### Physical disturbance

Physical disturbance of the soil can kill existing plants and bring buried weed seed to the surface. By removing native plants and exposing freshly turned soil, competition is reduced and germination and growth of weeds is encouraged. Disturbing the soil may be necessary in land management; for example, in construction or maintenance of dams, ripping rabbit burrows and repairing eroded areas. However, disturbance to native grassland may be avoided or minimised with care.

If the soil is disturbed for necessary works, the area should be rehabilitated. Rehabilitation might include levelling the soil, removing weed species that germinate on the area and sowing, or encouraging natural recruitment of, at least the native plant species that dominate the adjacent vegetation.

### Soil structure

Any activity that might change the organic matter, porosity, water permeability or moisture retention of the soil, such as compaction by vehicles or earthworks that alter water drainage patterns, should also be avoided.

### Chemical disturbance

Any temptation to enhance the sward with fertiliser, or other soil ameliorants, should be resisted. An increase in the level of phosphate or nitrogen, or a change in pH may give a competitive advantage to exotic plants. The soils under native grasslands have evolved with the plant and animal community. Any substantial change to their chemical fertility is likely to change the composition of the grassland.

### Stockpiling, dumping and spreading

Many areas of native grassland on public land have been used for quarrying or stockpiling soil or gravel for construction purposes. Some gravel pits are quite large and have been dug within areas of good native vegetation. These would involve substantial cost and effort to rehabilitate. Soil and gravel stockpiles provide a place for weeds to colonise and produce seed, which can then spread into adjacent vegetation. No new gravel pits or stockpiles should be established within areas of significant native grassland.

### Soil management in summary

- avoid or minimise any physical disturbance of the soil
- control weeds and revegetate if disturbance becomes necessary
- do not modify the chemical fertility of the soil
- avoid soil compaction by regular traffic along the same route by vehicles or heavy equipment
- avoid or minimise earthworks and other development which alters drainage patterns
- do not establish new gravel pits, or soil or gravel stockpiles in native grassland



*Soil disturbance removes competition and encourages weeds to germinate and grow. In this case near Cooma, native grassland has been converted to a very weedy paddock by repeated cultivation.*

## Fauna habitat management

Native grassland can provide shelter for small animals in the form of grass tussocks and inter-tussock spaces, soil cracks and holes, rocks, shrubs, trees and their bark, fallen timber and litter. Each of these niches provide places for small native fauna to shelter from the elements, predators and fire. In turn, the more niches there are and the more species of fauna shelter within the grassland the greater the abundance and variety of food for other species of fauna. A useful general principle is that to maximise the habitat value of a native grassland for a wide variety of fauna, the grassland should be managed to maintain or enhance the diversity of its structure and species composition.

### Structural diversity and shelter

Structural diversity can be provided not only uniformly across a paddock, but also by providing different types of structure in different parts of a paddock or landscape. This should be readily achievable, even difficult to avoid, in larger paddocks that contain different landscape units such as different slope angles and aspects, soil depths and even vegetation types. Managing grassland structure for maximum structural diversity may sometimes conflict with maximum short term pasture utilisation, but will provide other benefits such as provision of a dry feed reserve and a healthier grassland.

High grazing pressure resulting in lower herbage mass, clearing trees and shrubs, removing fallen timber and rocks, burning grassland in warmer months when small fauna are most active and vulnerable, or burning the whole area at once, will dramatically reduce the shelter value of a grassland.

### Species diversity and food

The fauna habitat value of a native grassland will also be enhanced by management that provides the biggest variety and supply of food for animals. The backbone of this food chain is the plants and the greater the diversity of plant species, the greater the variety of food types available to support fauna.

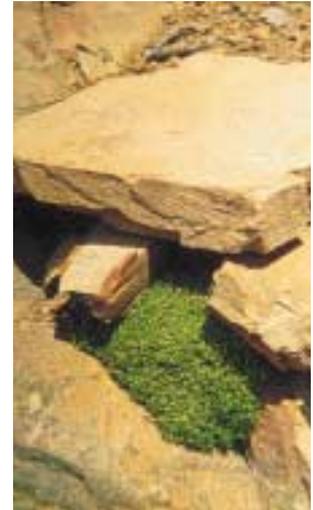
Native grassland can provide food for birds, reptiles, frogs, mammals, a wide variety of insects (both above and below ground) and an even wider variety of other soil organisms, each of which eventually become food for others.

## The web of life

Enhancing the variety of shelter and food for fauna, and thus the diversity and activity of fauna species in a native grassland, will enhance the growing conditions for plants and the health of the grassland. The habitat value of native grassland will be even greater when it contains or is adjacent to other healthy ecosystems, such as woodland, forest or wetland. Many animal species use native grassland for only some of their needs and need to spend some of their time in other ecosystems.

### Fauna habitat management in summary

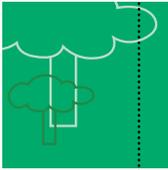
- retain trees, fallen timber, rocks, plant litter, tussocks and inter-tussock spaces
- avoid cultivation which will destroy soil structure, cracks and holes
- enhance structural diversity at a range of scales from individual tussock to landscape level
- enhance species diversity to maximise the variety of food sources for fauna



*Twin-flowered Knawel making use of moisture in a rock crevice.*



*A short, open structured grassland with a rocky surface, good structure and high species diversity.*



*These Snow Gums in a reserve near Berridale are typical of scattered tree populations within native grasslands.*

## Tree management

Native grasslands often include a scattered population of trees. Many paddocks on the Tablelands contain both treeless or lightly treed grassland, and more heavily treed plant communities of woodland or open forest.

### Native trees

Trees can have a strong influence on grassland structure and species composition through competition for light, moisture and nutrition. Trees also provide nutrition to the plants under their canopy through litter fall and by attracting birds and other animals that leave droppings under the tree. The natural populations of native trees within grasslands should be retained and managed as an integral part of the vegetation and have evolved with and continue to interact with the ground layer plants.

### Exotic and other non-local trees

Planting exotic trees, can have an even stronger influence on native grassland. Typically, grass species affected by shade are replaced by more shade tolerant grasses and the number of intertussock forb species is greatly reduced. Good examples of this can be seen in many rural cemeteries. Many exotic tree species also set seed which results in self sown exotic trees nearby. Exotic trees should not be planted in native grasslands and self sown exotic trees should be removed while they are still young.

### Tree management in summary

- retain native trees as integral components of native grasslands
- do not plant exotic or non-local tree or shrub species in native grassland
- remove self sown exotic trees (such as pine wildings) while they are still young
- consider removing older exotic trees (if present) and replacing with local native species

## Feral animal management

### Rabbits

Feral animals can have a strong impact on native grassland. Rabbits have a strong dietary preference for smaller and more succulent plants and plant parts. These are often the more vulnerable native forb, lily and orchid species. Diligent management of rabbit populations is important in the continuing conservation management of native grasslands. In rabbit prone country, exclusion of rabbits from native grasslands with boundary netting can be very valuable. In larger grassland areas, where the cost of rabbit netting has become prohibitive, a more popular approach is to manage the rabbit population at the local landscape level, fumigating and ripping burrows. Ripping burrows involves major soil disturbance and should be followed by the rehabilitation measures discussed under soil management.

### Cats and foxes

Feral predatory animals such as foxes and cats may also have an impact on grasslands, principally by hunting the smaller native animals such as small mammals, birds, lizards, snakes, frogs, spiders and insects. Predation by foxes and cats could cause local extinction or at least alter the balance of native fauna populations which could effect the ecology of the whole community. Feral cat and fox populations should be controlled in conjunction with neighbouring landholders and local authorities such as rural lands protection boards and shire councils.

### Pigs

Feral pigs can also have a strong impact on native grassland. A significant area can be severely dug up by pigs in a single night, doing as much damage as cultivation by machinery. Pigs have a preference for digging in the lower parts of the landscape, where the soil is deeper and more often moist. These areas contain the more sensitive and less well conserved types of native grassland. Grasslands adjacent to the shelter of timbered areas are more prone to this type of damage. Only diligent pig control in cooperation with adjacent landholders is likely to achieve effective control of feral pigs.

### Feral animal management in summary

- control rabbit populations and revegetate disturbed soil with suitable local grassland species
- control feral cat, fox and pig populations in conjunction with neighbours and local authorities

# MANAGING FOR LONG TERM CONSERVATION

Native vegetation management and conservation only becomes really meaningful and achievable when viewed in the long term. Vegetation composition and structure, particularly in grasslands, is highly responsive to external influences, and can readily be altered by management. A native grassland dominated by one species of native grass can be substantially altered and become dominated by a very different species (native or weed) either through intentional or inadvertent management.

## Planning for management

Good management of native grasslands for conservation in the long term requires adequate knowledge and continuing input of resources and commitment by managers, the community, governments and funding agencies. A management plan is essential to support considered management actions, seek assistance and as a basis for monitoring success.

## Native grassland enhancement

With appropriate and sensitive management it is possible to improve the quality of native grasslands. Through assisted rehabilitation, the structure and composition of the grassland community may be returned to a state that more closely resembles its natural condition. Interest in harvesting seed from wild populations, producing seed in seed orchards and nurseries, and purchasing seed for revegetation and landscaping has burgeoned in recent years. Specialised equipment and techniques are being developed, produced and promoted. However, great care should be used in collecting or harvesting seed from wild populations and in introducing seed to existing native grasslands. Wild populations of plants differ in their genetic make-up. Moving genetic material from one population to another can cause harm to the local population. In general, when introducing seed to a grassland it is safer to use the most locally sourced seed practicable to avoid this problem. When this is not possible expert advice on the likely risk should be sought. Collection of plants and seed in the wild is also subject to legal restrictions which vary from state to state.

In a more natural condition, native grasslands are likely to improve the stability of the landscape and enhance its capacity to support industries and communities. Populations of the less common native species of plants and animals might also be increased and become both more visible and sustainable.

## Monitoring

### Adaptive management

Careful monitoring of native grassland management can be invaluable in revealing the grassland's responses to both management and natural events and their interactions. This information can then be used to direct and improve management in response to any undesirable change. This process of monitoring the results of management actions and adjusting or adapting management accordingly is called adaptive management. A good place to start is with a survey of the condition of the grassland and the species present. This will provide a benchmark for monitoring and comparison.

### Photopoints

Changes in the species composition and structure of native grassland often take place without being recorded. Simply taking photographs in the same direction from the same reference point (like the top of a strainer post) can record useful information when compiled over a number of years. General trends, such as changes in the prevalence of major species (e.g. Kangaroo Grass, Poa Tussock, African Lovegrass or Sweet Briar), or outstanding seasons or flowering events can be revealed.

### Detailed measurement

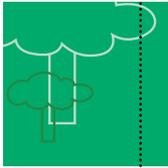
Another technique is to measure botanical composition at some regular interval. This can reveal more subtle changes, particularly in the less obvious species. This more detailed method requires more specialist skills, experience and resources. Managers can obtain advice or assistance in monitoring through local or state government agencies, the various threatened species and ecological community Recovery Teams and special interest community groups.

## Community involvement

Many individuals and community groups are interested in being involved in and contributing to nature conservation. These people are a potentially valuable resource in the conservation management of native grasslands. Neighbours and local community groups are likely to better understand and appreciate native grasslands and their value if they are actively involved in their management and enhancement. Some of the knowledge of native grasslands gained in this work is likely to be taken away and applied in other grasslands on both private and public land. Such community involvement is likely to be of benefit to the local and broader communities and to long-term conservation of grasslands across the region. Contacts provided under 'Public assistance' overleaf can help you with ideas, including what has worked elsewhere. The types of assistance include: survey, monitoring, weeding, fencing, seed collection and propagation, replanting.



*Monitoring grassland composition as part of a Landcare project on Middlingbank Peninsula, Lake Eucumbene.*



## Tourism

Growing awareness and appreciation of our natural environment and native vegetation has opened new opportunities, such as environmental tourism, for rural communities. If remnant native grasslands become recognised as good quality, well managed examples of the original native vegetation, they could become significant drawcards in a region's portfolio of tourist attractions.

## Public assistance

A number of organisations can provide assistance in conservation management of significant native grasslands, grassy woodlands and their component species. Managers should consider seeking assistance in managing native grassland areas with conservation values, through these organisations:

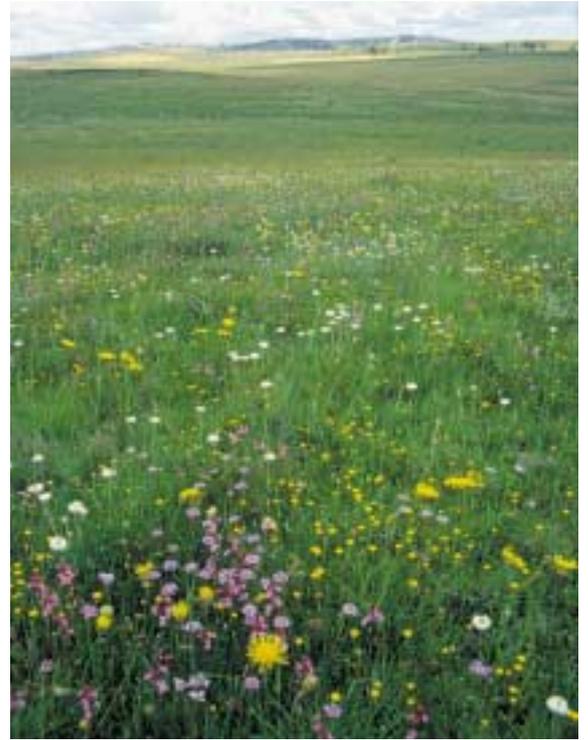
- WWF Australia
- Greening Australia
- South-East Australia Grassy Ecosystems Networker
- shire councils
- rural lands protection boards
- NSW Department of Land and Water Conservation
- NSW National Parks and Wildlife Service
- Environment ACT
- Environment Australia
- Agriculture, Fisheries and Forestry Australia and similar agencies in other states

## More work needed

Much work has now been done to identify, classify and protect native grasslands. However, considerably more work is needed before we can be confident that we have succeeded in conserving the most significant native grassland areas. Beyond this, conservation management of native grasslands will require on-going active management in the long term.

## Helpful publications

A kit called the Grassy Ecosystem Management Kit: a guide to developing conservation management plans (Sharp et al 2002), has been produced to help grassy ecosystem managers develop their own conservation management plan. This and other useful publications are listed at the back of this booklet (see Further Reading and Resources).



*Top Hut Travelling Stock Reserve at Dry Plains - an example of how temperate natural grassland in full flower can rival our famed alpine wildflower displays and could become a drawcard for regional tourism.*

## Long-term conservation and enhancement in summary

- make a commitment to on-going active management of your native grassland
- develop and implement a suitable management plan to reduce threats and enhance potential for recovery
- do not over harvest when collecting seed from native grasslands
- use the most local seed available when introducing seed to a grassland
- conduct a survey or inventory of the condition and species present in your grassland
- incorporate a suitable monitoring program into your management plan
- use adaptive management to incorporate the results of this monitoring into your management
- seek advice and help in conducting your survey, management planning and monitoring
- consider how you could involve the community in the management of your native grassland
- consider participating in native grassland activities in your region to broaden your experience
- consider seeking advice and funding assistance from community and government organisations

## References and further reading

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WWF Australia is working to conserve Australia's native vegetation. Our programs aim to reduce excessive clearing of land and the effects of salinity and introduced species on our environment. Together with Australian communities, we are working to expand protected areas and ensure our land is well managed for the future.



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