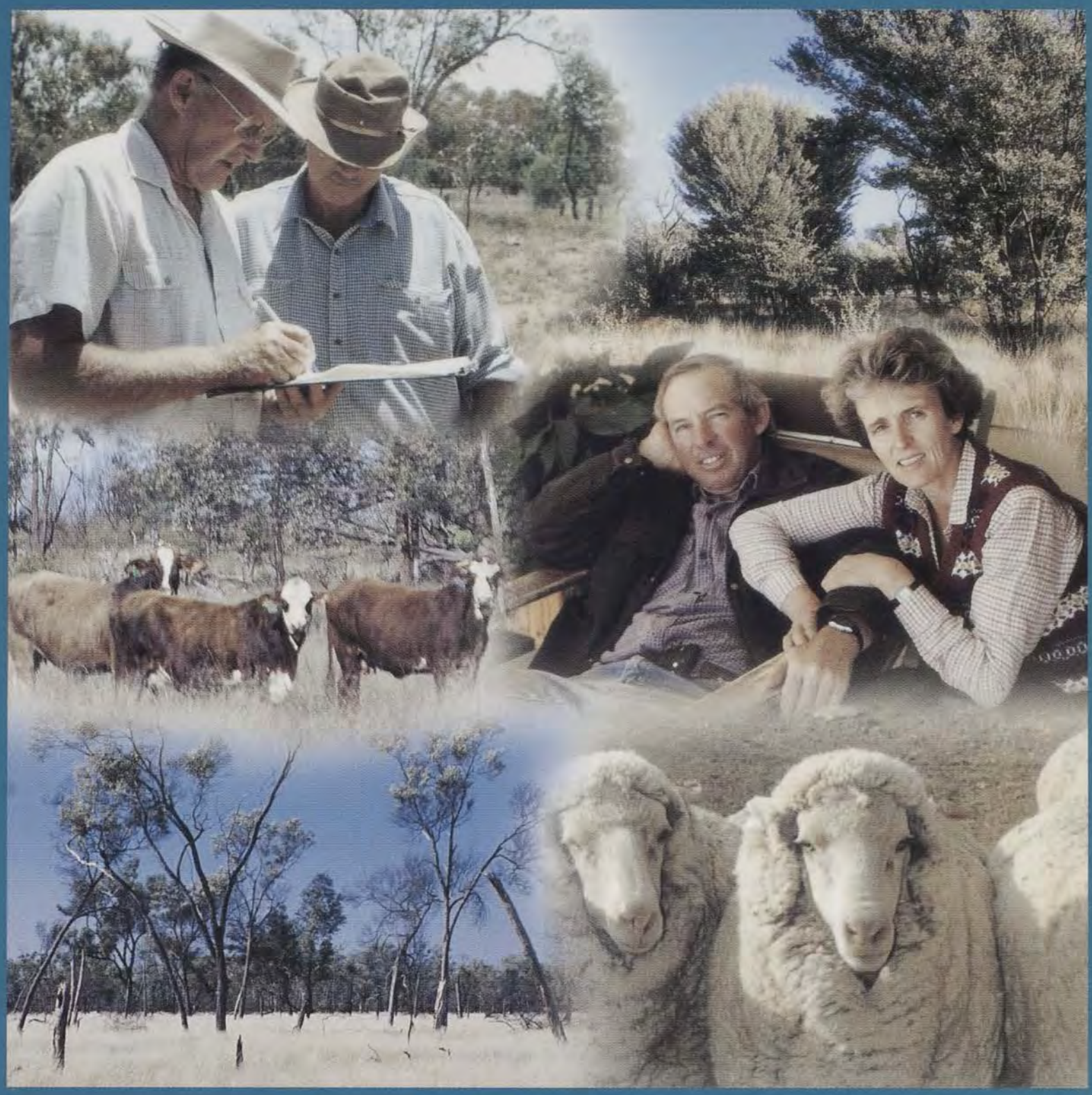
QI00078

Graziers' experiences
in managing mulga country



Jill Heywood, Ken Hodgkinson, Steve Marsden and Lester Pahl

Information series QI00078

Graziers' experiences
in managing mulga country

Jill Heywood
Department of Primary Industries, Queensland

Ken Hodgkinson
CSIRO Wildlife and Ecology

Steve Marsden
CSIRO Wildlife and Ecology

Lester Pahl
Department of Primary Industries, Queensland

Department of Primary Industries • Queensland • 2000

QI00078
ISSN 0727-6273
ISBN 0 7345 0117 X

This book is the third in the rangeland management series, available from NSW Agriculture. The previous two books are:

- The glove box guide to plants of the NSW rangelands
- The glove box guide to tactical grazing management for the semi-arid woodlands.

This publication resulted from the project 'Tactical Management of Total Grazing Pressure in the Mulga Lands of the Murray-Darling Basin', funded by the Murray-Darling Basin Commission. The project was a co-operative activity between the Department of Primary Industries Queensland, CSIRO Wildlife and Ecology and NSW Agriculture.

Information contained in this publication is provided as general advice only. For application to specific circumstances, professional advice should be sought.

The contents of this publication do not purport to represent the position of the Murray-Darling Basin Commission. They are presented solely to stimulate discussion for improved management of the Basin's natural resources.

The Department of Primary Industries, Queensland and CSIRO Wildlife and Ecology have taken all reasonable steps to ensure the scientific information contained in this publication is accurate at the time of publication. Readers should ensure that they make appropriate enquiries to determine whether new information is available on the particular subject matter.

© The State of Queensland, Department of Primary Industries 2000

Reprinted 2001

Copyright protects this publication. Except for purposes permitted by the Copyright Act, reproduction by whatever means is prohibited without the prior written permission of the Department of Primary Industries, Queensland. Inquiries should be addressed to:

Department of Primary Industries
GPO Box 46
Brisbane Qld 4001

Contents

Summary

Ten pastoral families from the mulga lands of New South Wales and Queensland have described the types and outcomes of their grazing management practices, including:

- the use of fire to control woody weeds;
- stocking rates and grazing management strategies;
- agistment and sale of livestock;
- livestock handling and performance;
- improvement of pasture composition and productivity;
- advantages of livestock mixes;
- use of mulga browse, and;
- management of goats and kangaroos.

These practices—that suit individual managers at particular times and places—are provided as information and options for consideration by other graziers.

Mulga (*Acacia aneura*) communities cover approximately 1.5 million km^2 or about 20 per cent of the Australian continent, and around a fifth of the Murray-Darling Basin. Other types of country such as the Mitchell grasslands, spinifex, flood and gidgee country also occur within the mulga lands. Together these types of country support a rich array of plant and animal life, and multiple land uses.

Mulga country has changed during 150 years of pastoral activity. For example, shrubs and trees have steadily invaded open grassy woodlands, largely due to a reduction in the incidence of fire, and an increase in total grazing pressure. At the same time perennial grasses have declined.

Graziers believe that there is no single 'right way' of managing mulga country. Each property is unique in its structure and land types, and each manager has their own personal style of management that is continually adjusted to suit the prevailing climatic and economic conditions.

Graziers are in business for the long term, and hence sustainability always has to be part of profitability. A universal goal of graziers is the maintenance or improvement of native pastures. This is often achieved through conservative stocking that limits the utilisation of grasses by resting to rejuvenate pastures and by burning to suppress encroaching woody weeds.

An increase in the financial value of feral goats has resulted in widespread harvesting and subsequent reduction in their numbers. In contrast, the economics of kangaroo harvesting have not improved and they remain a problem for graziers, especially when their numbers peak after a series of wet years. The commercial kangaroo industry offers respite for some graziers, while others attempt to reduce kangaroo grazing pressure by controlling waters and by maintaining tall and rank pastures that are unfavourable to kangaroos.

While there is no single 'right way' of managing grazing in the mulga lands, the key is to know and continually read the country, and adapt management practices to suit ever-changing conditions.

Acknowledgments

Funding from the Murray-Darling Basin Commission, the Department of Primary Industries Queensland, CSIRO Wildlife and Ecology, and NSW Agriculture made this publication possible. It was produced by the project, *Tactical management of total grazing pressure in the mulga lands of the Murray-Darling Basin*. The project saw graziers, rangeland scientists from DPI, CSIRO and NSW Agriculture, and representatives of community, industry and government groups come together to share their knowledge and work on a wide range of grazing management issues.

The contribution of grazier knowledge and experience was essential to the success of this publication and project. The authors gratefully acknowledge the amount of time and effort contributed by these busy people.

We also appreciate the many people and organisations that contributed information for comment boxes and who provided feedback on drafts. Wendy McLeish provided editorial advice, and coordinated the publishing of this book.

The following people contributed photographs used in this book:

Jeff Anderson, Graham and Merrita Baker, John and Sharon Blease, Peter and Mary Bryant, Neil and Lyn Cadzow, Peter Connelly, Alan and Jacki Cooney, Fay Cooney, Environmental Protection Agency, Jill Heywood, Ken Hodgkinson, Nicole McLennan, Tony Mills, Will Muller, Bernard O'Shannessy, Lester Pahl, Elysa Riedel, Richard Silcock, James and Sue Stirton.

Finally, we especially thank the following graziers who helped plan, implement and review many project activities—Dick and Deidre Beshman, Nick Brown, Bob Browne, Dawn Cartwright, Fay Cooney, James and Libby Gardiner, Michael McKellar, Beanie MacKenzie, Jacqui and Tony Mills, Bernard O'Shannessy, Shane and Kerry Smiles, and Margaret Vetter.

Introduction

Graziers' experiences in managing mulga country presents the accumulated experience of many decades of managing pastoral properties in mulga country, as told by graziers. While it does not recommend particular grazing management strategies, it does provide information on practices that are working for graziers.

Grazing is first and foremost a business. There are many issues that need to be addressed if the business is to be successful. The management of grazing pressure is just one of these. Grazing businesses also devote a great deal of time to marketing, animal husbandry, finance, climate analysis, and maintenance of infrastructure. All are important, and all have a bearing on the management of grazing pressure. Similarly, family and social issues influence management and must be balanced with the needs of the business.

Total grazing pressure is defined as the total demand for forage by animals, divided by the total amount of forage available. This ratio is often high during drought, when the combined number of domestic livestock, feral goats, rabbits and kangaroos is high relative to the amount of feed available in paddocks. Under these conditions both pastures and animals can rapidly deteriorate.

The inspiration for *Graziers' experiences in managing mulga country* came from grazier workshops. Graziers reported that they benefited from discussing ideas and issues with other graziers as they spoke the same language and experienced the same challenges. They also wanted knowledge arising from scientific research to be available in the publication. Graziers were interviewed about their experiences in managing mulga country and, as much as possible, the case studies were written in their own words.

Grazing management practices have developed to suit individuals, enterprises, country types and times.

Graziers' experiences in managing mulga country is designed to complement two publications that have been produced by NSW Agriculture: the *Glove box guide to plants of the NSW rangelands*; and the *Glove box guide to tactical grazing management of the semi-arid woodlands*. It also complements the publication on the grazier survey undertaken by this Murray-Darling Basin Commission project: *Grazier perceptions of total grazing pressure in the mulga lands.* These are briefly described in the *References* chapter.

There are three key sections:

1. The mulga lands environment—describing the natural systems of the mulga lands.
2. Ten grazier case studies—covering a range of geographic locations, enterprise types and management philosophies, supplemented with the findings of scientific research.
3. Common themes—summarising the grazing management practices mentioned in the case studies.

The mulga lands environment

The mulga lands are the second largest plant community in Australia, covering approximately 1.5 million km^2 or about 20 per cent of the continent, and around a fifth of the Murray-Darling Basin. They extend from the Western Australian coast, across the southern edge of the central deserts into western New South Wales and south-west Queensland. Mulga (*Acacia aneura*) communities occur in semi-arid and arid environments on red earth soils, where rainfall is low (150–500 mm/year) and erratic, and where periods of drought are common.

Mulga country often occurs alongside other land types such as Mitchell grasslands, spinifex, flood and gidgee country. Together these types of country support a rich array of plant and animal life as well as multiple land uses.

Figure 1. Australia's mulga lands and the Murray-Darling Basin.

The mulga lands — past and present

The mulga lands of the Murray-Darling Basin have changed considerably in vegetation structure since European settlement. Natural wildfire from lightning strikes combined with the burning practices of Aboriginal people created open grasslands with scattered shrubs and trees. The grazing pressure of native animals was generally low due to the scarce and temporary nature of surface water.

Mulga lands have retained native vegetation cover

The arid and semi-arid pastoral zone of the Queensland Murray-Darling Basin has the highest proportion of uncleared native shrub and tree communities of all the Murray-Darling Basin. For example, the eastern mulga lands have a shrub and tree cover of 66 per cent. This compares well with more developed regions such as the eastern Darling Downs where only 10 per cent of the original tree cover remains.

However, within the Queensland mulga lands less than 10 per cent of the original brigalow and gidgee vegetation remains, and these communities are considered endangered. Other communities that are endangered or of concern are belah and brigalow, bowyakka and bendee, mountain yapunyah and belah, and virgin poplar box.

Robyn Cowley, Department of Natural Resources Queensland (DNR), 1998.

The introduction of domestic livestock and feral animals dramatically increased grazing pressure. The addition of permanent watering points supported these introduced animals as well as promoting the increase of some native animals such as kangaroos, placing enormous grazing pressure on perennial grasses and forbs. The suppression of fire by grazing and browsing of potential fuel, wildfire control and reduction in prescribed fire also allowed native trees and shrubs to establish and increase during favourable rainfall periods, transforming open grasslands into shrublands and woodlands that are now very dense in places.

Prior to pastoralism, open and grassy mulga woodlands were maintained by frequent and extensive fire.

The dominance of woody plants

Despite the present dominance of woody plants in the mulga lands of eastern Australia, there is good evidence that prior to settlement most of the mulga was open woodlands. Today, it is not uncommon for mulga densities to exceed 5 000 stems per hectare or one stem for every two square metres. In some areas, woody weed species, such as hopbush and turpentine, can exceed 15 000 stems per hectare. Vegetation, such as forbs and grasses, are disadvantaged at such high shrub densities.

Graham Harrington and others, Commonwealth Scientific and Industrial Research Organisation (CSIRO), 1984; Bill Burrows, DPI, 1985; Sandy Booth and others, University of New South Wales, 1996.

Since the late 1800s, pastoralists have been confronted with two major vegetation problems: woody weed increase and the decline of palatable perennial grasses. Both are largely the result of too much grazing pressure from domestic, feral and native animals, and suppression of fire.

Vegetation of the mulga lands is continually changing in response to climate, fire and grazing. Changes can be slow and insidious, such as the establishment of shrub seedlings over many years until they appear as a blanket of vegetation, while major episodic events, such as drought, fire or flood, can have immediate and profound effects on the structure and composition of vegetation.

Pastoralism and conservation

Pastoral management that encourages native palatable perennial grasses and reduces shrubs directly addresses several conservation needs. Firstly, perennial grasses provide ground cover that protects the soil surface from the erosive effects of rainfall, as well as enhancing ecological processes, such as run-off/run-on processes. Secondly, perennial grasses provide food and shelter for many animals and insects.

A diversity of plants and animals

The wide range of ecosystems within the mulga lands supports a diverse array of native plants and animals. For example, the mulga lands bioregion of Queensland contains 747 plant, 256 bird, 56 mammal, 94 reptile and 23 amphibian species.

Here, six plant species are listed as vulnerable. Small native mammals, including the greater bilby, plains rat, and western quoll have become extinct locally. A further 6 per cent of mammals, 7 per cent of reptiles, 4 per cent of birds, 5 per cent of frogs and 2 per cent of plants are recognised by governments as rare or vulnerable.

Bruce Wilson and Sally Egan, Queensland Parks and Wildlife Service (QPWS), 1996; Bruce Wilson, QPWS, 1997; Robyn Cowley, DNR, 1998.

Conserving water and nutrients

A characteristic of the mulga environment is the spatial redistribution of water and nutrients which is strongly influenced by terrain (slope and soil surface roughness) and vegetation (mulga groves, litter, perennial grasses and logs). Rainfall is rapidly redistributed (as run-off) from sparsely vegetated areas that are unable to absorb or obstruct water. Patches of vegetation capture this water (as run-on), along with soil, nutrients, litter and seed. By concentrating and conserving these resources, these patches become enriched over time and become very productive.

Figure 2. Build-up of a mound by a perennial grass tussock with the accumulation of wind-blown or water transported materials, and the formation of biopores in the soil through which water can flow. (David Tongway and John Ludwig, CSIRO, 1997)

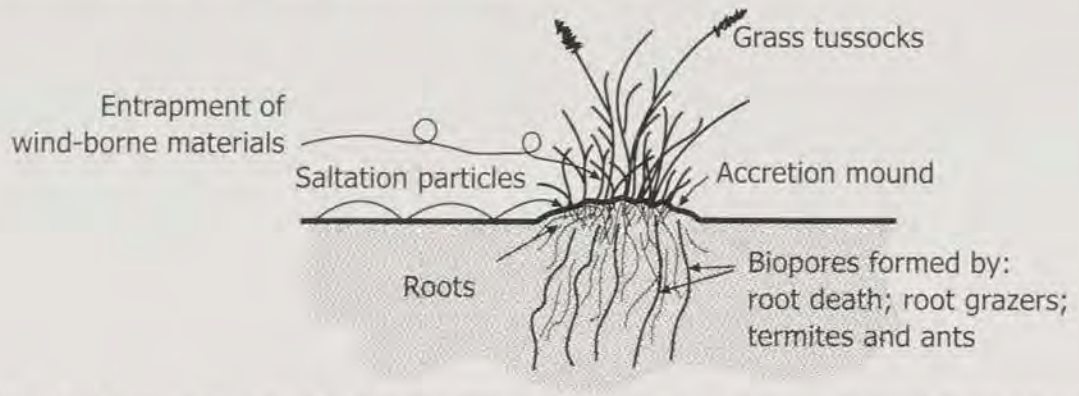
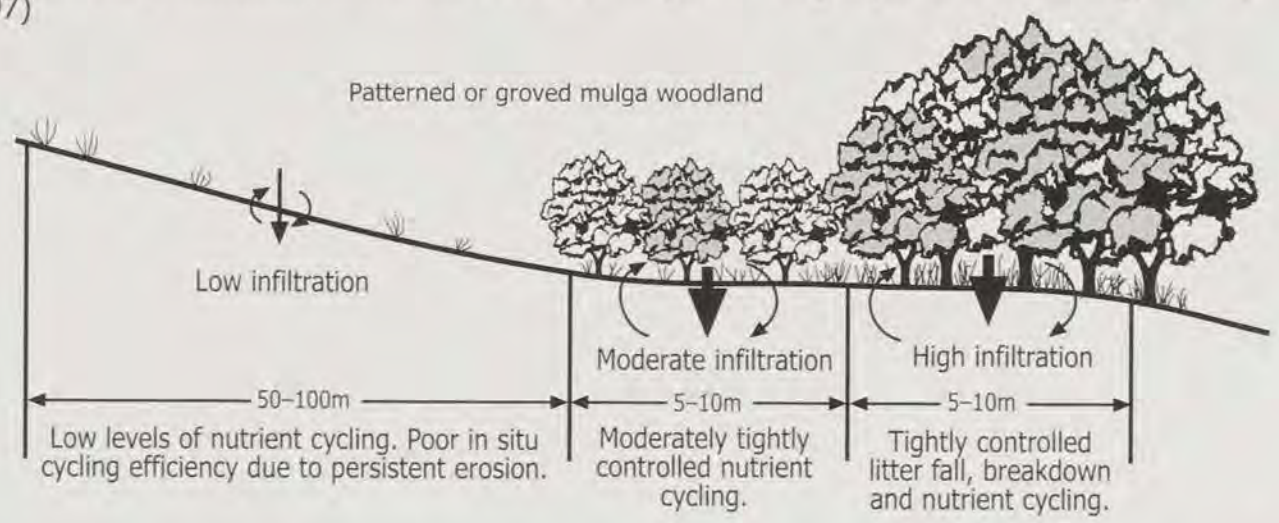


Figure 3. Cross-section of a typical grove-intergrove mulga landscape that intercepts run-off from open slopes with low water infiltration rates. (David Tongway and John Ludwig, CSIRO, 1997)



The loss of vegetation, through over-grazing or drought, can dramatically reduce the landscape's ability to capture water and nutrients, resulting in the loss of potential forage production.

Land uses

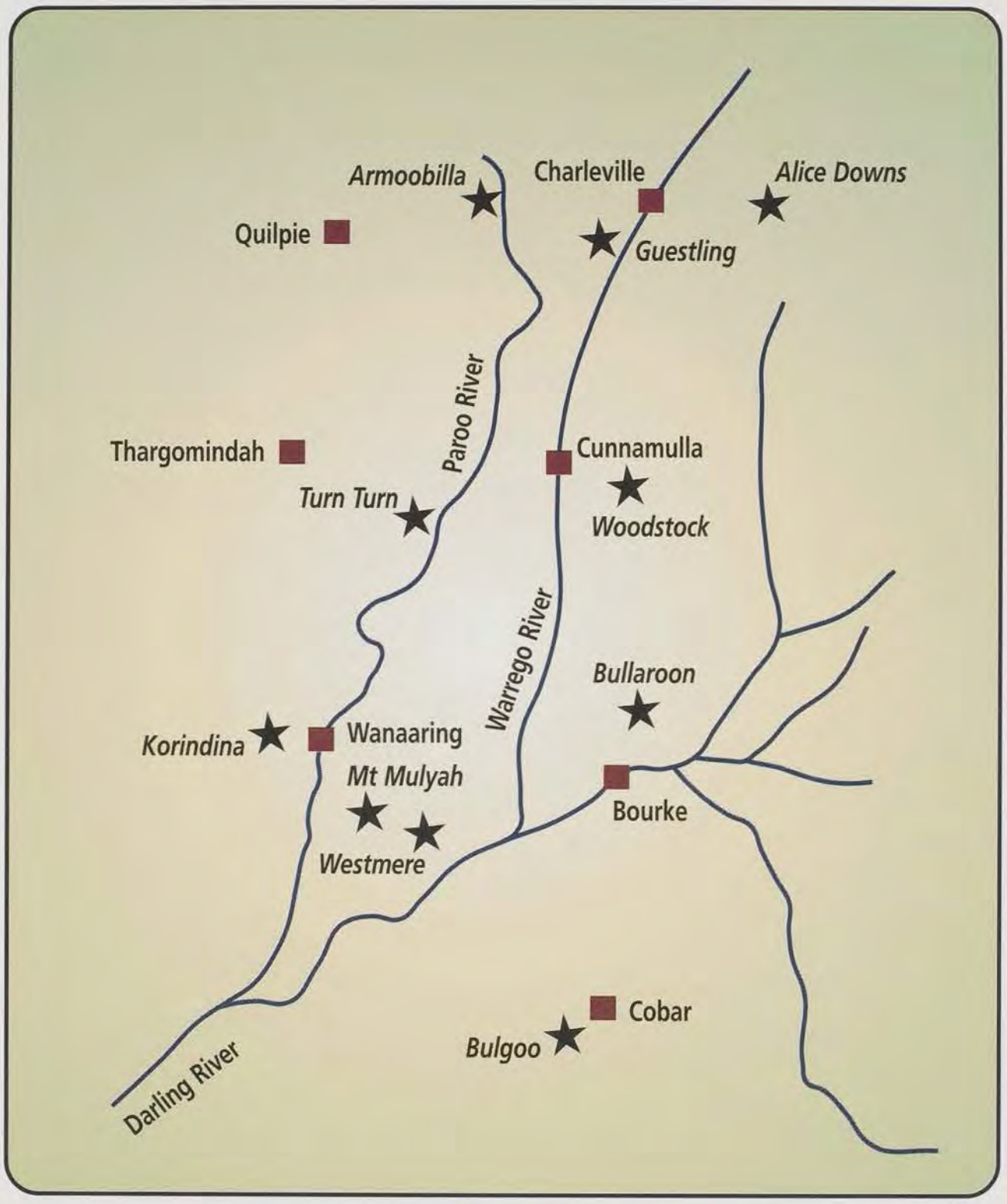
The mulga lands support many uses of land including pastoralism, culture of indigenous people, nature conservation, mining and tourism. New land uses are emerging—such as the harvesting of native plant and animal products—and many businesses are diversifying. The mining and tourism industries contribute more to the gross national product than does pastoralism, however, pastoralism utilises the majority of the land area in the mulga lands. In this respect, pastoralists have a special responsibility to manage the mulga lands for all Australians.

The challenge for the people who live and run businesses in the mulga lands, and for government policies, is to balance social, cultural, environmental and economic needs. Land uses should sustain the ecosystems and the biodiversity they contain, and the well-being of people that live in the environment of the mulga lands.

Case studies

In the following 10 case studies grazing families across the mulga lands of New South Wales and Queensland describe their properties, enterprise types, grazing management strategies, and the outcomes of years of hard work and observation. The case studies are supplemented with the selected findings of scientific studies from a range of research organisations.

Figure 4. The location of the 10 case study properties.



1 Improving pasture performance

Graham and Merrita Baker
***Guestling*, Charleville**

Mechanical thinning of shrubs and trees, burning, and sowing pasture have served to increase productivity and livestock carrying capacity on *Guestling*. Graham and Merrita are diversifying through the addition of goats to their enterprise, to improve returns and help manage pastures and woody weeds.

Property size:	13 000 hectares (32 123 acres)
Average rainfall:	420 mm per annum
Enterprises:	wool, beef, goat meat
Livestock numbers:	5 000–5 500 sheep, 500 cattle, 600 goats
Land types:	39% scattered watercourse gidgee, sandalwood and yapunyah
	35% mulga, red box and sandalwood
	17% stony mulga ridge
	6% flooded coolibah gidgee
	3% gidgee and scattered mulga
Waters:	creeks, earth dams and a bore

Key messages from *Guestling*

- The gradual thinning of areas infested with woody weeds has arrested a decline in carrying capacity as pastures have improved.
- Good returns on goat meat, the availability of feral goats, and their possible role in woody weed management were some of the reasons for diversifying into goats.
- Kangaroos are managed by a licensed harvester when they are seen to congregate in specific areas.
- Burning to control woody weeds is usually done in spring and has had good results in controlling green turkey bush, sandalwood and poplar box suckers.

Stocking strategy to suit the land types

We use a set stocking strategy, which means that most paddocks have livestock in them all year round. The breeders are always run on the better country while the red box-sandalwood country is used for steers, wethers and weaners after shearing. Animals are rarely shifted between paddocks although sheep will occasionally be put into a different paddock after shearing. The set stocking strategy suits us because our land types limit where the different classes of animals can be run. On this particular property we feel it is the only way to do it.

We don't under-stock but we try and stock our country reasonably. There's no profit in continuously under-stocking. You've got to treat it kindly but also make some money out of it.

At this stage the goats are run with the sheep but the aim is to reduce sheep numbers and eventually run goats with cattle, and sheep with cattle. We believe that the new mix will not be so hard on the country as goats and cattle don't graze as low as sheep. One reason for running goats with cattle is that much of the better country is being fenced for goats but still needs to be used to run breeder cattle. Also, running goats and cattle together is thought to reduce worm problems in goats as cattle do not carry the same worms and will break the life cycle of the larvae.

In the particularly good years we may take on extra cattle, maybe a couple of decks on agistment, if they can be turned off without putting too much pressure on the country. Generally though, no major changes are made to livestock management during the good seasons as those years are used to build up a good seed bank or fuel for a burn.

Channel millet thriving from good seasons and moderate stocking rates.

During long dry spells we sell what we can in terms of dry animals. There is little mulga available for feeding and feeding grain or hay is not considered a cost-effective option. We have agisted the breeding ewes in the past but since pulling and improving some country by sowing buffel grass this has not been necessary.

Burning to control woody weeds

Burning is usually carried out in the spring and has achieved good results in the control of woody weeds, particularly green turkey bush, sandalwood and regrowth from poplar box suckers.

Effect of fire on woody weeds

Seedlings of all woody weed species are killed by fire. As shrubs grow in height some species gain strong resistance to fire damage, others have some resistance, while a few have no resistance. Shrubs such as mulga, green turkey bush, hopbush and punty are killed by fire but will come back from germinating seed as soon as three years after fire.

Shrubs such as sandalwood (budda), turpentine and grey turkey bush are less affected by fire and their sprouting ability means that usually only 15–25 per cent is killed. However, the surviving shrubs do not produce seed for about five years after burning.

Ken Hodgkinson, CSIRO, 1991 and 1998.

Reducing timber and woody weeds to grow more grass

A long decline in the carrying capacity of the land due to the regrowth of trees and shrubs occurred on *Guestling* over several decades. In the 1930s the previous owners ran 9 000 sheep on the property. At that stage the property was open, grew plenty of grass and had a rated carrying capacity of 1 dry sheep equivalent (DSE) per 1.4 hectares (3.5 acres). By the time we arrived in 1947 the rated carrying capacity was 1 DSE per 1.8 hectares (4.5 acres) but we were running only 6 000–7 000 sheep.

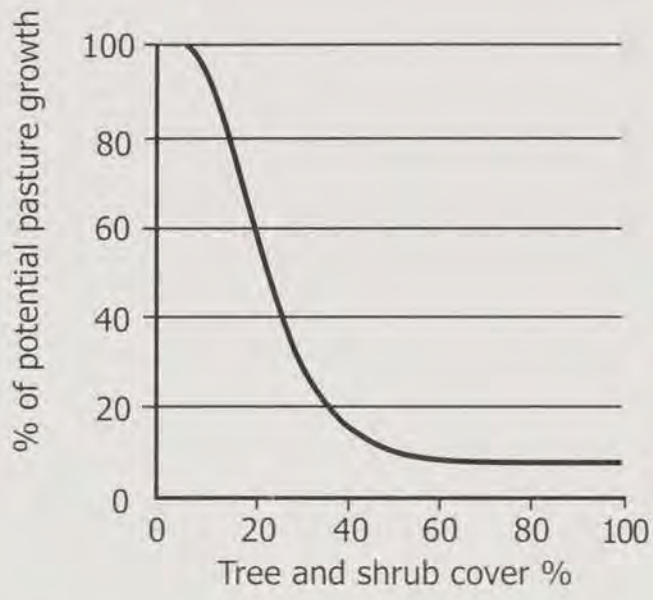
Several decades of shrub and tree regrowth.

Between 1947 and 1969, most of the mulga on the property was fed to livestock, resulting in the loss of drought reserves. In 1971 there was 550 mm of rain in the early part of the year, yet sheep had to be moved onto agistment by December. The density of the timber and woody weeds was not allowing the grass to grow and there was no stubble to allow the grass to get away quickly when rain did fall. It seemed that the grass had to come from seed every time it rained which meant we had to have a number of falls to get any pasture growth.

Impact of tree thinning on pasture production

The following graph relates to a range of land systems across south-west Queensland and shows that for areas with high tree and shrub cover, the potential to produce pasture is rarely realised (for example, at 60 per cent cover, less than 10 per cent of potential pasture actually grows). It is not until canopy cover is reduced below 20 per cent that maximum potential growth is realised.

Ian Beale, DPI



The likely impact of tree and shrub cover on potential pasture growth.

Between December 1971 and September 1972, *Guestling* ran 3 000 sheep, which further declined to 800 sheep between September 1972 and July 1973. From 1981 to 1986 we were forced to obtain agistment on seven different places, and at that stage we decided that something needed to be done. Between 1981 and 1987, 3 400 hectares (8 400 acres) that had been invaded by regrowth was thinned, leaving big old trees and desirable patches. A fire generally followed this within four to five years to reduce regrowth and remove logs on the ground. The total cost was $83 500 but we avoided borrowing money and increased the area only as funds became available, treating a further 470 hectares (1 175 acres) with our own equipment.

Wildlife and perennial grasses

The diversity of plants is presumed to greatly decrease in areas of thick mulga or turkey bush regrowth and where land is otherwise degraded. The loss of native perennial grasses can result in a significant decrease in local plant and, perhaps, faunal diversity. It is the loss of perennial grasses through grazing or encroachment by shrubs and trees that is the likely reason for the decline of ground dwelling native birds such as the Squatter Pigeon and Plains-Wanderer.

Robyn Cowley, DNR, 1998.

There was virtually no mulga Mitchell grass left on the property until we thinned the timber and woody weeds, but now it is coming back. As soon as the rain fell there was an abundance of grass and herbage—many of which we had not seen here before. We can only assume that the seed was there from many years ago when the regrowth was not so thick. Since opening up the country, native wildlife, particularly birds, also have become well established and, at the same time, we have been able to improve the productivity of the country.

Open and grassy paddock following the thinning of regrowth.

Lifespan of seed

Research has found that buried seed of buffel grass, mulga oats, silky umbrella grass and mulga Mitchell grass mostly dies after about two years. However there is a small proportion of seed that lasts for many years, probably decades.

Shrub seed lasts in the soil many years longer than grass seed. Research has found that 50 per cent of hopbush seeds buried under trees were still alive after eight years. This means that there will always be pockets of shrub seeds somewhere in the landscape, just waiting for the right conditions to germinate.

Richard Silcock and Flora Smith, DPI, 1990; Ken Hodgkinson, CSIRO, 1997.

Establishing the right pasture mix

Some seeding has been done on the property with silk sorghum grown on the flooded areas and buffel grass in the red box country. As well as increasing overall productivity, it seems that competition from buffel grass has reduced the amount of turkey bush. In this area if you could have a 60–70 per cent buffel grass pasture with the rest native, you would have a good balance. Some of the native grasses have good features. For example, the mulga oats and mulga Mitchell grass will green up if you have some winter rain but they are not so good in terms of volume of feed.

The benefits of diversifying into goats

We have always run a sheep and cattle breeding operation on *Guestling* but three years ago we began to diversify into goats. There were a number of factors that prompted this change in our business. These included the relatively good returns on goat meat compared with wool, the availability of feral goats on the property, the need to diversify to help spread risk and the possibility of using goats in the management of woody weeds, such as sandalwood.

In the past, feral goats had been mustered and sold whenever the opportunity existed. However after deciding to move into domestic goats the feral numbers were allowed to build up. Over the past year around 600 feral goats were mustered, 100 of the surplus males sold and the remainder placed behind an effective, but expensive, bipolar electric fence. Although the number of feral goats on the property has significantly declined, we will continue to harvest and domesticate them.

Needs-basis kangaroo management

Kangaroo management occurs on a needs-basis at times when kangaroos are seen to congregate in one area. This tends to occur after isolated showers or when burning creates patches of sweet, green feed. In these situations we get a kangaroo harvester out for a couple of months and this has generally been effective in reducing kangaroo numbers. We do have quite a few kangaroos but since they don't seem to flock to one particular area, it has been a few years since we have considered it necessary to have a harvester. Having other people harvesting around the area probably helps keep the numbers down too.

In conclusion, woody weed treatment, burning and diversification have been some of the grazing practices used to increase pasture and animal production.

2 Higher productivity through three enterprises

John and Sharon Blease
***Bullaroon*, Bourke**

Declining wool prices and increasing costs of running sheep have encouraged John and Sharon Blease to diversify into cattle and goat production. The combination of the three enterprises allows different types of country to be utilised more efficiently.

Property size:	29 400 hectares (72 650 acres)
Average rainfall:	350 mm per annum
Enterprises:	wool, beef, goat meat and stud goats
Livestock numbers:	4 400 sheep, 500 cattle, 2 000 goats
Land types:	soft mulga, spinifex, flood plains
Waters:	artesian bores, bore drains, ground tanks

Key messages from *Bullaroon*

- A mix of three livestock enterprises gives more options and gets more out of the country without over exploiting it.
- Mulga drought proofs the property as it supports livestock through drought.
- Mulga should be fed to livestock early in a drought before pasture and animals have lost too much condition.
- Cattle are used to keep mulga within browsing height of sheep and goats.

The three enterprise mix

We like the three-way structure of sheep, cattle and goats. You get more out of your country because each type of animal is suited to grazing particular types of country, as well as using different components of the vegetation.

Wool, beef and goat meat: the three enterprises of *Bullaroon*.

Mixed species grazing

Sheep and cattle prefer grasses and herbage but shift readily to browsing shrubs and trees when grasses diminish in drought. Their dietary overlap can be high, but in some areas cattle may consume more browse and more dry grass. Goats tend to have a broader diet than sheep and cattle, and consume more browse throughout the year. At times their diet is almost entirely browse.

Differences in diet composition, ranging behaviour and reach of sheep and cattle can be used to increase profitability in mulga country without increasing overall stocking rates. Cattle open up tall pasture to sheep, and differences in their grazing behaviour means that they will often utilise different plants or different parts of the paddock. For these reasons mixed herds of sheep and cattle can be more profitable than sheep alone. The reduction in sheep numbers in mixed herds can be more than offset by improved per head production, and by the income from cattle.

Bill Holmes, DPI, 1986; Robin Barker, CSIRO, 1987.

The only problem with running the three enterprises is that there is always some grazing activity or operation that needs to be done. However, it gives you a diversity of activities and the demands of any one activity are lower than if it was the sole enterprise on the property.

If you're established in a number of enterprises you can easily increase or decrease your exposure to them. For example, we may further reduce sheep numbers and increase goat numbers if wool prices don't pick up.

Mulga is an essential element in our grazing strategy

Mulga is an important part of our grazing strategy. The mulga here is good mulga. It is palatable and the plants are at a height where the leaf is readily accessible to stock. The majority of mulga on the property was pushed during drought in the sixties and has since regenerated but the cattle have kept it at a controllable height. This is critical because mulga that has grown above the browsing height of cattle is no longer available as feed.

Sheep (or goats) and cattle are complementary grazers because the cattle break down the upper branches of the mulga creating a hedge effect. The broken

branches provide leaf for the sheep as well as encouraging leaf production in the lower parts of the tree.

Every mulga tree is worth a bale of hay.

We find that mulga drought proofs the property. Sure, flood country will make more money because it's a lot more productive in the good seasons. However, you will always get dry seasons, and that's why mulga country handled in the right way is an asset not a liability.

Mulga regrowth after browsing by stock.

Nutritional value of mulga

Mulga leaves and small stems make up a diet that is very coarse, has a low dry matter digestibility (50 per cent), a low metabolisable energy content and a crude protein content of 10–14 per cent. Feeding a supplement made up of two parts stock salt, one part sulphate of ammonia and one part Kynofos (or other phosphorous supplement) improves the digestion of mulga and it has been found that supplemented sheep can eat more mulga leaf and produce 10–20 per cent more wool than unsupplemented sheep on mulga.

Ross Clarke, DPI, 1987; Ian Partridge, DPI, 1996.

When should you feed mulga?

You shouldn't allow your livestock to lose too much condition before you start feeding mulga. If you start with a fat score of two or more you'll hold them, otherwise you may lose them. Our heaviest losses were in the 1994 drought when we lost 8 per cent of our sheep. The cattle hold on well when fed with mulga, but calving will be affected. It's important to only run as many cattle as the mulga will support.

Feed mulga early and if you have to feed for a long period, the animals will stay with you.

Running Merinos on flood country

Merino ewes are run on the flood country; this is good breeding country that gives good lambing results. The best time to join the ewes is February. We always try to give the younger sheep the softer country. Even within the generally hard mulga country (less productive) there are softer paddocks (more productive). For example, the two-toothed wethers and the cattle are grazed on the softer mulga paddocks while older wethers can handle something harder.

We shift all the sheep off the flood plain country if it's starting to look over-grazed or if it's under water. The ewes are put into the mulga paddocks. The flood country is delicate so you have to respect it—you can't over-stock it.

Running cattle on mulga country

Cattle were introduced as a management tool to contain the mulga. The cattle have kept the mulga low, creating a hedge effect and making the mulga leaf more accessible to sheep. The Santa Gertrudis and Santa Gertrudis/Short Horn cross herd has gradually increased up to the present 280 breeders.

Cattle are kept together on the mulga country and predominately eat mulga year round. The sheep usually eat anything that comes up before the cattle can eat it. This country is deficient in phosphorus so we put out a home-made lick, which also aids in the digestion of the mulga.

Lick blocks

Lick blocks provide a supplementary source of nitrogen (usually urea), energy (molasses) and minerals (sulphur, calcium, phosphorous, salt and trace elements) to animals grazing low quality (dry) pasture or mulga. Lick blocks assist the digestion of pasture as well as increasing the feed intake. The variable intake of the blocks by individual animals is a problem that can be largely overcome by giving animals access to the blocks at an early age.

Russell Hodge, Agriculture Victoria, 1991.

Managing domestic goats

The goat enterprise started three years ago (1997) to diversify away from wool. We use a 4 050 hectare (10 000 acre) paddock that consists of spinifex, woollybutt and mulga scrub. This year we stocked moderately (one breeder to four hectares or 10 acres) and marked 150 per cent kids on what would be some of the hardest wool growing country.

We use Boer bucks to get the kids to slaughter weight quicker, although some feral bucks still manage to get in. We also have a Boer goat stud operation.

The returns from the 2 000 goats on the 4 050 hectares (10 000 acres) of hard red earth spinifex/mulga country are more profitable than the 4 400 sheep on the softer country.

Low wool prices are an obvious reason for these economics but the costs of chemicals and shearing are also important. Goats have minimal costs (except for fencing), as we never use chemicals.

We plan to go into goats in a bigger way and run goats with cattle. However the cost of fencing is the greatest hold back. We plan to ease into a hinge joint perimeter fence around four existing paddocks and use electricity for subdivision.

This will give us an area of 8 000–10 000 hectares (19 770–24 700 acres). One drawback is the lack of control due to the large paddock size. Although if you don't get a clean muster the goats are still going to be there—fly won't get them.

We find that goats at moderate stocking rates are softer on the country than sheep. When it rains sheep live entirely off the ground, while goats will browse as well, allowing grasses to establish. Goats don't seem to graze the grass as short as sheep either. That's why we think the cattle and goats will go well together. With the goats we wouldn't be surprised if the grass comes back.

Kangaroos are part of the country

There are always a lot of kangaroos in this area. We have a shooter that comes in once a week, but kangaroos are part of this country and you just try to keep these animals at a controllable level. They create additional grazing pressure and are hard on the hinge joint fences, but the biggest problem is after rain when they hammer the open country. They also move in on the watercourse country when you get small floods.

Kangaroos contribute around half of the total grazing pressure on many properties.

The combination of the three enterprises can be challenging at times, but it is a rewarding challenge. We consider we are making better use of the country, without over exploiting it.

3 Achieving goals through conservative stocking

Peter and Mary Bryant

***Mt Mulyah*, Louth**

A conservative stocking rate, with adjustments under dry conditions, has been part of the approach used on *Mt Mulyah* to produce a good product and to maintain the resource.

Property size:	48 600 hectares (120 100 acres)
Average rainfall:	265 mm per annum
Enterprises:	wool, beef
Livestock numbers:	9–10 000 sheep, 200 cattle
Land types:	soft country, sandhills, flooded country
Waters:	artesian and sub-artesian supplies

Key messages from *Mt Mulyah*

- The country is moderately stocked, even during favourable seasons, to allow feed to build up.
- Surplus non-breeding livestock are sold with the onset of drought to maximise feed reserves for the breeders.
- Blade ploughing followed by fire provided good control of woody weeds.
- It is important not to make hard and fast management rules but to assess each situation as it arises.

Goals for successful land management

Our aim in managing the land is to provide ourselves with a reasonable living, consistent with the capability of the land. First of all we're looking after ourselves, we want to grow a good product, we want to be proud of what we grow and we want to maintain the resource that we've got. We want our sheep to be robust, well grown animals producing a soft handling bulky fleece under 23 microns. We want to continually improve the quality of our livestock so as to ensure sufficient returns without putting too much domestic grazing pressure on the pastures.

Spreading livestock across the country

We try to maintain a conservative stocking rate and will always run less than we feel it is safe to run. As a result, livestock are generally spread out across the property with cattle on the Cuttaburra flood country, younger sheep on the best of the red country and older sheep across the rest. All paddocks are usually stocked, but we will spell various paddocks from time to time to allow feed to build up for fattening or weaning.

The Cuttaburra flood plain is well suited to grazing cattle.

We think that one of the worst things you can possibly do is to try and compensate for the amount of money you're not making by trying to make more out of running more livestock.

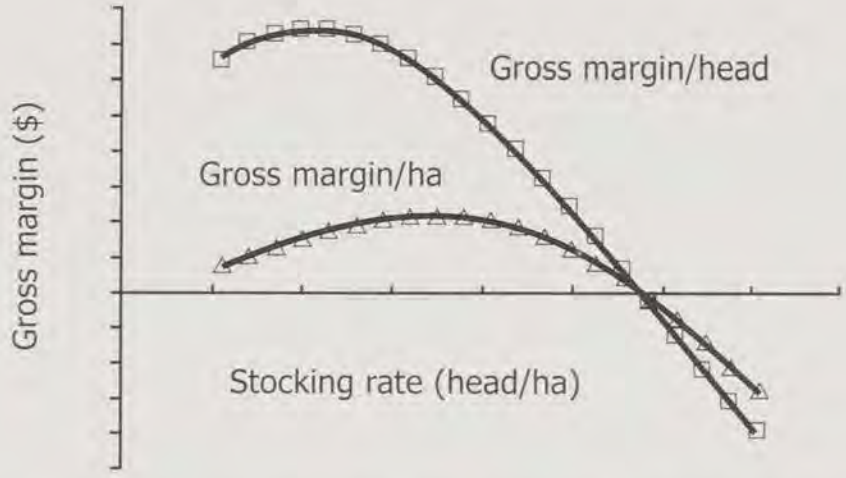
Conservative stocking

Many sheep and cattle pastoralists in the rangelands have gained benefits from conservative stocking. These include improved reproductive performance, better growth rates, lower mortality, and a reduction in the incidence of destocking. Benefits are greatest during low rainfall and drought years, when both livestock and pastures maintained a higher and more constant level of condition.

Even in non-drought years, numerous investigations have shown that income can be maximised using low to moderate stocking rates, both for cattle and sheep. For example, the graph below shows that maximum gross margins from per head wool production occur at moderate stocking rates. Gross margins per hectare increase slowly and then fall away quickly with increasing stocking rate, due to the poor performance of individual sheep at the higher rates.

The general rule of thumb is that around 90 per cent of the maximum gross margin can be obtained by running only 70 per cent of the sheep needed to achieve the maximum value. Therefore, a 30 per cent drop in stocking rate results in only a 10 per cent drop in gross margins.

Overall, conservative stocking can increase per head and per hectare returns, provide greater flexibility in marketing, and decrease economic and climatic risk.



The relationship between stocking rate (head/ha) and gross margin (per ha and per head).

Bob Wynne, Department of Conservation and Land Management (CALM), 1992; Ian Beale, DPI, 1996; Rosemary Buxton and Mark Stafford-Smith, CSIRO, 1996; Angela Rose, DPI, 1998.

Adjusting numbers in dry times

Naturally, when we do get severe downturns in seasonal conditions we have to reduce numbers significantly by selling surplus livestock. We presently have two mobs of wethers and one mob of culled ewes. The culled ewes and one mob of wethers will go regardless of the markets but what we do with the other mob of wethers depends on the season. If we get a really flush season we'll try to keep them and spread them out as much as possible. But even in good seasons we try to keep a lid on the numbers to allow the country to recover a bit.

In the extremely dry years in the 1960s we sent sheep on agistment to preserve the good bloodline that had been developed. It cost a lot of money and we were still forced to sell a lot of sheep at low prices, but I think we'd still consider agistment in isolated drought situations.

It's about not making hard and fast rules about any option but assessing all of them when the situation arises.

Managing non-domestic grazing

In the early days, rabbits were a massive problem but since we've been here the population has decreased due to myxomatosis and rabbit calicivirus and they are no longer considered a nuisance. There is absolutely no question, though, that in the absence of rabbits the feed supply is providing more for kangaroos. However, it's a shame to see just one native animal getting the lion's share when there are a whole lot of native animals that should be coming back.

Kangaroos are harvested occasionally from the property, by a locally based licensed harvester. In the past, when prices were more favourable and tags more available, we had a harvester living at a nearby homestead with his own chiller box. Dealers would come out and collect the animals and the system worked very effectively.

As well as reducing kangaroo numbers, a good harvester helps us out by checking bores and assisting in feral animal control.

The practice of skin-only harvesting should be an option for resource managers because of the limited market for kangaroo meat. The reduction of kangaroo numbers eligible for harvesting (due to minimum weight requirements) has dramatically affected the viability of kangaroo harvesters, making it necessary for alternative measures such as exclusion from water.

Goats have also increased in numbers from virtually none 20 to 30 years ago to the extent where we recently mustered 900 in one morning. We muster them now whenever it is convenient, using motorbikes and aircraft, and sell them to a buyer in Louth.

Feral goats provide a ready source of funds and breeding livestock.

Composition of grazing animals on *Mt Mulyah*

In December 1991 the density of sheep, feral goats and kangaroos were estimated on three properties around *Mt Mulyah.* The average densities of these animals were 0.25 sheep, 0.29 feral goats and 0.13 kangaroos per hectare. These figures varied greatly across paddocks, and on average kangaroos and feral goats made up 50–70 per cent of the grazing animals. At the time conditions were very dry and feed supply scarce. Under these conditions feral goats and kangaroos hastened the onset of feed shortage by about six months.

Jill Landsberg and Jacqui Stol, CSIRO, 1996.

Using fire to manage vegetation

We have also observed an increase in the amount of scrub on the property and believe that fire is the most economical way of controlling it. We have found blade ploughing to be very successful but it needs to be followed up with a burn as soon as you have the opportunity. In 1984–86 we blade ploughed and burnt 3 600 hectares (9 000 acres). It was conducted strategically in narrow strips along fence lines, around waters and in isolated patches. Although heavily grazed by kangaroos after the burn, the woody vegetation was severely reduced and is only now starting to come back in some areas. We would definitely consider burning it again if the opportunity arose.

I can think of times in the past when we could have had a huge blaze and killed a lot of the scrub but were too frightened about the possibility of the fire getting away to light up. The possibility of litigation is also a deterrent.

Shrub encroachment

Since settlement, graziers have had to contend with a general increase of shrubs in the mulga lands. Shrubs will always tend to increase, unless they are kept in check by management. These photographs, from a fixed point, of an unstocked area of *Runnymede* (near Coolabah, NSW), show the natural increase. Above average rainfall in 1984 germinated seeds and established the shrub seedlings. In the 1950s Ron McKay, a previous owner, could see trains on the Nyngan–Bourke line from a dam near the site of these photographs. Today, woody weeds totally obscure the line.

1982

1986

1990

1999

Encroachment of shrubs into grasslands over a period of 17 years.

I guess my view on fire changed with the general acceptance by the Rural Fire Service that hazard burning was a legitimate tool in wild fire control. This policy shift provided graziers with the opportunity to burn when the conditions were suitable.

Encouraging native grasses

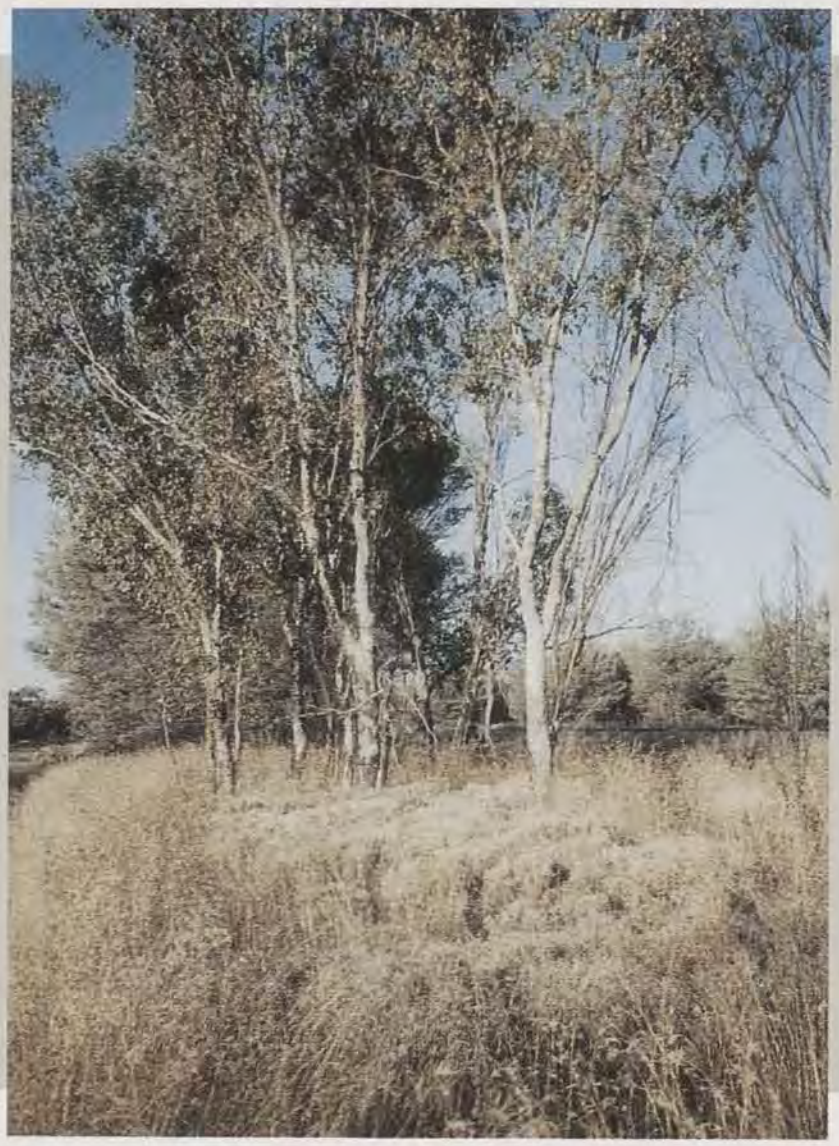
In terms of the pastures, I have some concerns about the potential for buffel grass to form a monoculture and try to encourage the native pasture species by establishing small fenced exclusion areas; by running a conservative number of domestic livestock; and by controlling native and feral animals.

Buffel grass and mulga country

Buffel grass seedlings need higher levels of soil phosphorous and nitrogen to establish compared with seedlings of native grasses. The low fertility of most mulga soils means that buffel is mostly found directly under deep rooted eucalypts such as poplar box, where nutrient levels are higher.

Buffel has become well established on patches of fertile soil in mulga country, such as alluvial systems. Buffel pastures in these areas can be productive, reasonably palatable when short and green, and relatively drought resistant. However buffel grass is frost sensitive, and rapidly deteriorates in quality as it ages and dries off. When this occurs, the palatability and nutrient content of buffel dominated pastures compare poorly with native pastures.

Richard Silcock, DPI, 1986; Ian Partridge, DPI, 1996.



Buffel grass restricted to patches of soil nutrient under poplar box.

In conclusion, we have found that the conservative stocking strategy suits us well and allows us to achieve our management goals. In terms of specific management options we feel it is important not to make hard and fast rules but to assess each situation as it arises.

4 New ways of doing business

Neil and Lyn Cadzow
***Alice Downs*, Morven**

A willingness to embrace new ways of doing business on *Alice Downs* has led to the introduction of cattle and goats, and the use of a stocking system that pays careful attention to pasture type and grazing patterns.

Property size:	21 000 hectares (51 900 acres)
Average rainfall:	500 mm per annum
Enterprises:	wool, beef, goat meat
Livestock numbers:	3 000 sheep, 600 cattle, 1 800 goats
Land types:	30% mulga-poplar box country
	16% jump ups (ridges)
	10% hard mulga
	9% Mitchell grass downs
	7% poplar box flats and water courses
	5% cypress pine country
	23% mixture of above
Waters:	dams, bores and semi-permanent waterholes in creeks

Key messages from *Alice Downs*

- Cattle and goats introduced to the original sheep operation provide benefits of diversification and co-grazing.
- Goats need to be run at a reasonable stocking rate for good reproduction and returns.
- Within a conservative stocking strategy the paddock grazing pressure is controlled using water closure, fencing to land types and destocking after periods of good rainfall.
- Dung sampling of cattle is used to provide a greater understanding of pasture protein and digestibility.

Establishing a suitable livestock mix

Alice Downs was exclusively a sheep enterprise when we purchased the property in 1985. Nine years ago we introduced cattle and in 1997 goats became part of the enterprise. When we first came here it was dry and the sheep were doing alright but there were lots of bare areas. Since we have changed our mix to include cattle we have more feed because cattle don't chew the grass down as low as sheep, which means the pasture can get away more quickly after rain. Goats are kinder on the country than sheep as they leave a lot of grass while sheep will clean up almost everything. Sheep are still needed in the system to control mulga but they just don't pay at the moment. With this in mind, we have started looking into something like the Damara sheep meat breed that provides an alternative to Merino sheep without the fencing costs associated with goats.

Introducing goats

Since going into goats three years ago, 7 of the 15 major paddocks on the property have had fences rebuilt and electrified. Angellala Creek has been fenced off and goats are now run on both sides of the creek. We chose to use that area for goats because the fences needed redoing and we could electrify them as we went.

We put 900 nannies in two 1 200 acre paddocks with a fair bit of thick mulga (pushed regrowth) for 12–14 months. They cleaned up all the mulga but we didn't get many kids out of them—you don't expect to when you've got them stocked heavily like that.

Fence rebuilt and electrified for holding goats on *Alice Downs.*

Like any domestic livestock, goats need to be run at a reasonable rate if you want good reproduction and returns.

Changing grazing pressure

Sheep, cattle and goats are grazed using a set stocking system in some paddocks. This is because these paddocks are too big to shift livestock frequently. The down side of using this approach is that it can result in a lot of wasted feed

in some areas and over-grazing in others. For example, we used to have six paddocks that had Mitchell grass downs country in the corners. The animals would stay on that country and flog it out even though there was some good grass growth in other areas of the paddock. The little bit of feed they could get on the downs country was sweet and they'd just chase it.

Whilst the overall approach is one of set stocking, there are a number of strategies we use to overcome these problems and to vary the grazing pressure from domestic livestock throughout the year. For example, the issue of over-grazing on the corner patches of Mitchell grass downs was dealt with by fencing to land types. This effectively isolated the downs country into a separate paddock. The Mitchell grass has been slow to come back but we have found we can speed that up through managed grazing. We have found that grazing the plants down to about 15 cm then removing livestock and allowing the plant to tiller, grow and set seed results in greater seeding and faster regeneration.

Controlling waters is another method we use to spread the grazing across a paddock. Some of the paddocks have multiple watering points, which means that cattle can be encouraged to graze in other areas of the paddock by closing gates at the fenced watering points. However, this does not seem to work for sheep, they will tend to hang around a closed watering point rather than moving elsewhere. Grazing pressure is also varied by moving cattle in and out of goat paddocks and by rotating livestock in some of the smaller, easier to muster paddocks.

Assessment of land types on *Alice Downs*

The table below summarises what we believe are the strengths and weaknesses associated with the different land types on the property.

Land type	Strengths	Weaknesses
Open Mitchell grass downs	Very productive	Over-grazed when mixed with other land types in one paddock
Gently undulating plains–mulga and poplar box	Very good for breeding and drought feed	Reverts back to thick mulga when rested too much
Hard mulga	Will be productive drought feed, with a lot of work	Very prone to over-grazing and erosion
Poplar box flats and water courses	Good buffel country as trees help cycle minerals	Trees can become too thick with improper management
Cypress pine	Country well sheltered	Can become overgrown with young pine Light carrying capacity
Jump ups (ridges)	Will probably grow buffel without timber control	Very steep Heavy erosion Very rocky

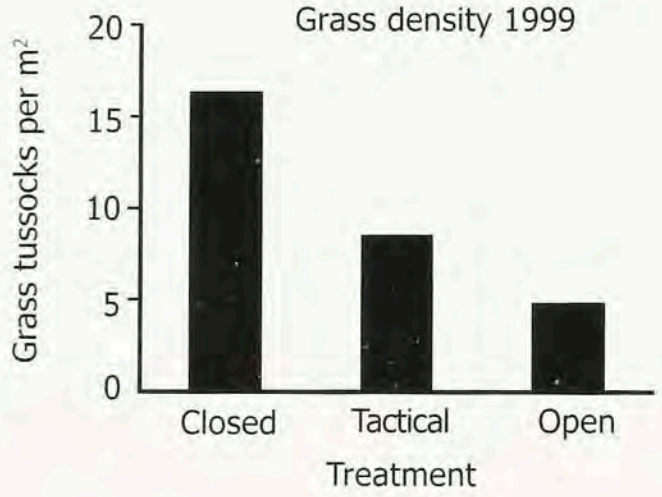
How pastures are rested

Complete removal of livestock at certain times of the year is also part of the strategy and aims to encourage pasture regeneration. For example, we used to shear in February so we could move all the livestock into one easy-to-muster paddock. There's normally good rain around the end of February, and the absence of animals in those other paddocks gave the pasture a chance to get away and go to seed. I think that's the secret but obviously you can't do it all over the place.

Tactical rest study

A study was set up in 1996 to examine the effects of three grazing treatments. These were: excluding all grazing (closed), grazing as normal (open), and tactical resting based on whether the last three months rainfall total had fallen below 75 mm, or the height of palatable grass plants had fallen below 10 cm or suitable rainfall to grow a crop of grass seed had occurred. These treatments are on 10 properties in the mulga lands of NSW and Queensland. *Alice Downs* was one of these properties.

The study is still in progress but important trends are emerging. On 8 of the 10 properties there has been a significant build up of grass when tactical rest was applied as a treatment.



The density of grasses within three different grazing treatments.

Ken Hodgkinson, CSIRO.

Tactical grazing on the right prevented the regeneration of mulga apparent in the ungrazed area on the opposite side of the fence.

Similarly, if we think it's going to be a really good season we might condense the livestock into a few paddocks and give other parts of the property a rest. In a good year, we'd also look at taking in agistment.

Resting after good rain gives the pastures a chance to get away and to set seed.

There are some paddocks on the property that will be rested for longer periods. For example, one paddock that we are resting to encourage the Mitchell grass hasn't been stocked for 18 months. Unfortunately, even though there is no water in the paddock, it's being hit very heavily by the kangaroos. We have a regular kangaroo harvester so we let him know when and where we're resting pastures so that he can focus his efforts on these areas. We also let him know which areas we've recently burnt.

Kangaroo harvesters and the control of feral animals and kangaroos

Aside from reducing the number of kangaroos congregating on specific areas, the harvester also assists with feral animal control and currently has eight pig traps set across the property. Although currently averaging around 60 kangaroos per night, the overall impact of the harvester on the kangaroo population is hard to know and, from my observations, it would seem that the number of kangaroos is actually increasing.

Professional wild game harvesters help control numbers of native and feral herbivores.

Impact of harvesting on kangaroo numbers

Commercial harvesting of red kangaroos appeared to have little impact on their numbers on grazing properties near Blackall. The size of these populations did not change despite harvest rates of between 53 and 100 per cent of the total population on the property. It was assumed kangaroos from neighbouring properties migrated into the harvest zone to replace the animals that had been removed.

Tony Pople, University of Queensland, 1996.

Costs and benefits of burning

Another tool that has been used on *Alice Downs* to improve production is burning. Burning is useful in clearing pulled timber for better access, controlling regrowth, clearing old grass to allow for fresh new growth and in providing a seedbed for the planting of improved grasses. However, fire can have damaging effects if not managed correctly. For example, a fire that is too hot may result in scalding of the soil surface and stocking too soon after burning can damage pastures and lead to erosion.

Fire can be a cost-effective tool for controlling regrowth and maintaining productivity on grazing properties.

Economics of prescribed fire for shrub control

The costs of prescribed fire include those for constructing firebreaks, controlling the fire and in some cases, the income foregone when paddocks are spelled to accumulate fuel and/or rested after fire to grow forage. The benefits include increased livestock production, reduced mustering times and better control of pests such as blowflies, lice, feral pigs and foxes. Capital value of the land is also improved.

Simulated cash flows over a 20 year period for a pastoral business in mulga lands indicate that prescribed fire for shrub control is profitable. Payback periods vary but are often less than 5 years and are therefore extremely favourable. Despite this, users should carefully assess the maximum area that property cash flows will allow for setting aside to burn.

David Burgess, NSW Agriculture, 1988.

Dung sampling for improved nutrition

Changing the species mix, resting paddocks, fencing to land types, culling kangaroos and burning are some of the strategies we've used to manage total grazing pressure. The most recent method we're trying is dung sampling to provide information on pasture protein and digestibility. We hope to be able to sample on a monthly basis so we can keep an eye on what's happening and take measures to meet the nutritional demands of animals at times when the pastures are not supplying enough protein.

Goals for the next five years

Looking to the future, we have identified a number of goals for the next five years on *Alice Downs*. These are:

- burning to control woody weeds, rank grass and timber on the ground;
- fencing to reduce paddock size and allow for rotational grazing instead of set stocking;
- relocating or upgrading water points to accommodate paddock size;
- thinning thick mulga and false sandalwood to allow grass growth;
- reducing sheep numbers and increasing goat and cattle numbers.

In conclusion, the long-term goals for the property involve ongoing property development to increase production, with the possibility of introducing cell-grazing.

5 Three ways to rest pasture

Alan and Jacki Cooney
Turn Turn, Eulo

A unique resting strategy based on long-, medium- and short-term rest is being implemented on *Turn Turn* and the early results are positive.

Property size:	56 000 hectares (138 400 acres)
Average rainfall:	330 mm per annum
Enterprises:	wool, beef, Merino stud
Livestock numbers:	14 000 sheep, 1 000 cattle
Land types:	55% mulga (soft, hard and sandplain)
	25% alluvial flood plains
	20% gidgee (open to dense stands)
Waters:	waterholes and dams

Key messages from *Turn Turn*

- Short-term rest applied to paddock pairs after periods of beneficial rain has increased the amount of available feed.
- A seasonal rest of about four months is used to benefit specific pasture plants.
- Long-term rest applied to an area of 12 000 hectares (30 000 acres) aims to maintain a desirable pasture mix and a sufficient amount of browse.
- A flexible management approach, responsive to the circumstances is important.

Stocking strategy

One of the aims we have is to make sure the ecosystem is alive and functioning. What we hope to do is use grazing animals to keep those ecosystems active.

The stocking strategy we use involves a time controlled system that has been modified to suit the environment. The system is based on three types of rest. The first is opportunity resting which involves taking livestock out of an area after beneficial rain and keeping them out over the subsequent growth period, usually about six weeks. The purpose of this rest is to allow for maximum growth in grasses and annuals, and for plants to reach full maturity and set seed.

Diverse and healthy pastures showing the benefits of resting from grazing.

The second is a seasonal rest period of about four months. Because plants have different seasonal growth patterns this rest period is designed to coincide with the seasonal growth of certain plants. For example, resting in late winter–early spring will benefit salines (saltbushes) that only grow at that time of year.

Thirdly we are experimenting with a longer rest period. It is based on 12–18 months with no livestock in a paddock and waters closed off to allow all flora to rest and recover. It is mainly aimed at browse species, as it has been my observation that if you graze but don't rest, the leaf below the browse line of trees will be permanently lost.

Opportunity resting

The opportunity resting involves a paddock pairing system. Under this system each paddock is paired with another of similar size and carrying capacity, usually around 1 000 sheep and 100 head of cattle per paddock pair. Following beneficial rainfall all livestock are taken out of one side of the pair, part A, and put into the other side of the pair, part B. Part A is then given whatever time it needs to make most benefit of that rain and then the livestock that were moved to part B are returned to part A. After the next beneficial rain livestock are moved in the opposite direction to allow for resting in part B.

Different land systems respond differently to rainfall at different times of the year. For example, the response from recent rain will be considerably less in the southern areas dominated by sand plains than in the top parts of the property (soft mulga, hard mulga and gidgee country) where germination of grasses is likely. Therefore which paddocks are rested depends largely on where the rain

falls and how beneficial it is likely to be. An absence of salines and forbs around watering points can also be a useful indicator that pastures may need a rest.

At this stage 5 out of our original 10 paddocks have been paired and a fencing plan is in place to develop the rest. Opportunity resting has been applied to these paddock pairs on a dozen occasions and you can certainly see the benefits. One paddock, in particular, probably has about twice the available feed that it had six or seven years ago. We're also getting greater wool cuts and good lambings out of the paddock pairs. The main disadvantage with the system is the added cost to the business. For the plane and labour used in mustering, it costs us around $500 every time we shift animals from one side of the pair to the other.

This system allows us to go further into a dry time before we start to put too much stress on the ecosystem and have to destock.

How much grazing can perennial grasses withstand?

The key to managing palatable perennial grasses is to know when grazing causes plant death. If all green leaves are grazed from a grass plant, the roots stop growing and the plant goes into shock. Heavily grazed grass plants have weak root systems for extracting water from a drying soil and are more easily ripped out by grazing animals. Such plants rarely survive the dry times.

Studies north of Cobar NSW, have shown that during the major 1991 drought only 10 per cent of lightly grazed palatable grasses died while over 80 per cent of the heavily grazed grasses died. Heavily grazed grasses were also more likely to die in the early stages of drought.

Ken Hodgkinson, CSIRO, 1993.

Seasonal resting

When things get dry the strategy is to take a lot of the pressure off certain paddocks and put the pressure in other paddocks where mulga is being pulled. For example, we have five paddocks at the moment without any livestock in them. Now that we've had 50 mm of rain, in six weeks time I'll take all the livestock out of those paddocks where we've been feeding mulga until after the next beneficial rain. That's the seasonal rest that we're working on.

Pasture following the thinning of mulga regrowth and seasonal rest.

Long-term resting

The long-term rest is currently being applied to 12 000 hectares (30 000 acres), half of which has been rested for one year and the other half for two years. We have noticed that there are considerably more desirable perennial grasses, salines and browse in the rested areas but also more of the less desirable species, such as low successional grasses and turkey bush. In two years the proportion of desirable to less desirable species is much the same as before resting but I believe that as succession (gradual shift in composition of species) continues there will be an increase in the desirable species.

Mulga Mitchell grass has responded well to long-term rest.

Flexible management strategies

I really object to any formalisation of the management strategy. It has to be flexible. You weigh up your requirements and the resources that you have available and you try and balance them out as best you can.

Management has to be done on individual properties, considering the individual circumstances and those circumstances can change every day. Basically, you've got to be responsive to the circumstances you find yourself in.

Kangaroo harvesting and control of water points

Kangaroos are harvested on a regular basis by a professional licensed harvester who takes advantage of the paddock pairing system by focussing effort on the areas under rest. This means the harvester is able to take up to 90–100 kangaroos a night. What we would like to do is to control the kangaroos by being able to turn the waters on and off. This is something we hope to achieve, although this would be difficult to do at present because of the supply from waterholes and dams.

Kangaroo grazing pressure is not restricted by fencing, however some control can be exerted by turning off artificial waters in rested paddocks.

Controlling kangaroos in destocked paddocks

Kangaroo numbers have been observed to increase after a paddock has been destocked, especially when waters are not controlled. Closure of waters in destocked paddocks may not eliminate kangaroos, especially in small paddocks, but it may limit the increase and reduce their impact during hot, dry times when low water availability reduces the feed intake. Temporary closure of waters under these conditions will concentrate kangaroos in the vicinity for a few nights where they can be culled. Using this approach on waters in adjacent stocked paddocks may help limit the kangaroo grazing on destocked areas. An integrated approach that combines the control of watering points with harvesting or culling is required to reduce kangaroo numbers.

David Freudenberger, CSIRO, and Ron Hacker, NSW Agriculture, 1997.

In conclusion, I guess we've got short-, medium- and long-term goals. The short term goal is to pay our bills. Medium term is to develop the property along the lines set out in our property management plan. That is, to finish off the paddock pairing system, fence off the waters so we can use trap yards and control the waters during resting, and blade plough a small area to plant silk sorghum for opportunity fattening. Our long term goal is to retire comfortably.

6 A lifetime of observations

Allan Crawford
***Korindina*, Wanaaring**

Allan's keen observational skills and his experience in managing a range of mulga country have allowed him to gain a good understanding of the country over the past 50 years.

Property size:	42 000 hectares (103 800 acres)
Average rainfall:	275 mm per annum
Enterprises:	wool, beef
Livestock numbers:	6 500 sheep, 150 cattle
Land types:	65% soft red mulga
	35% mulga flats
Waters:	bores and dams

Key messages from *Korindina*

- Good sheep breeding is a key to success.
- Sheep should not be over-handled.
- Don't wait for the season to unfold–take some kind of management action before it is too late.
- Cattle are used to take the top off the coarse grasses, so that green growth will be accessible to sheep.
- Animals like a blend of different country within a paddock. They prefer to graze different types of country at different times.

Some history on the area

It has been reported that in the 1880s development was taking place in the area with fencing and the sinking of wells, bores and ground tanks. By 1888, the reported carrying capacity was three sheep to two hectares (5 acres). In the early 1890s the first drought occurred and no doubt contributed to a decline in land condition. Today, this country runs one sheep to five hectares (13 acres).

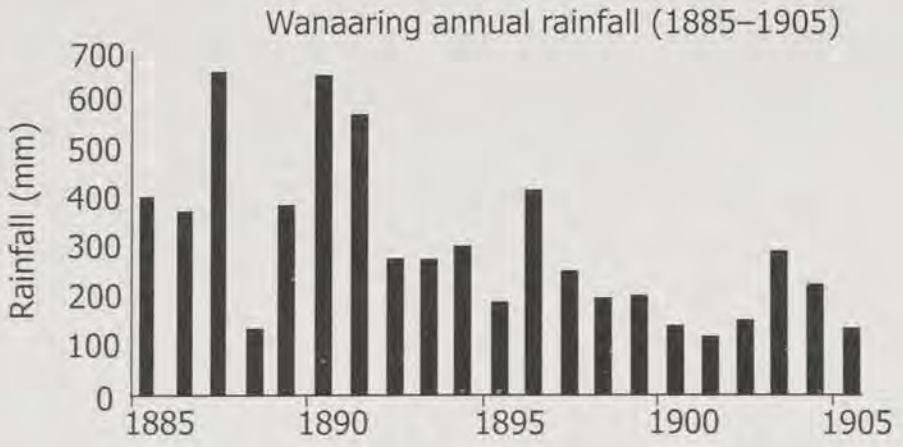
The rabbit, which by 1895 was reported in plague proportions, ravaged the grasses, herbs and edible shrubs in the region. The rabbits supported the dingo population, which also preyed upon the sheep. In the following years, increased numbers of kangaroos due to the greater availability of water, also contributed to grazing pressure.

I first came out to this area back in the late thirties, during the autumn school holidays. In 1946 I moved out here when my father bought me this property. Over the years I've had a couple of properties at Cunnamulla and another one east of Bourke. I had a partnership in a property at Hay and my daughter now runs a property near the Warrego. I started off with sheep and have stayed with them ever since.

Sheep numbers throughout the west have declined in recent years as graziers have diversified into cattle and goats. However, fine wool growing can still be profitable.

A false impression

The graph below shows the unusually high rainfall years of 1885 to 1891 (except 1888), which encouraged the rapid build-up of sheep numbers in the region. It would also have given new graziers a false impression of the long-term carrying capacity of the country. Subsequent years are more representative of the average rainfall of 275 mm.



Annual rainfall at Wanaaring from 1885 to 1905. (Source: Australian Rainman, 1999)

In the early years most of the property only had 'pony' fences—a single strand of wire that was only suitable for holding sheep. Over the years this was replaced with four-strand fencing. Currently, there are six paddocks. I subdivided one large paddock into three smaller paddocks of 4 600 hectares (11 400 acres), 1 900 hectares (4 700 acres) and 1 300 hectares (3 200 acres). The reasoning was to join ewes in the smaller paddocks. In hindsight, I don't know if it was a good idea as the woody weeds seemed to prosper more.

The property is well watered. I have sunk five bores and put in pipelines, reservoir dams and cement tanks. I find the open dams are much better for sheep than the water trough because of the high water temperatures in the troughs. Sheep will wait around until fresh water flows into the trough.

Managing on visuals

I manage on visual appearance of the country and, strange as it would seem, on hunches. You can have a good season or a drought. I work on my hunches, I don't wait for the season to unfold.

I don't believe in fencing off the good country in its entirety, because you need to have a blend of country to give animals a choice. For example, red country responds quicker to rainfall than sweeter country. Animals are therefore naturally attracted to the red country straight after rain. This gives the sweeter country a rest from grazing and it then supports animals during the drier times. You have to know your country to be able to manage it.

Animals need a choice of country to graze.

Breeding long-bodied sheep

I have 4 000 breeding ewes, 1 200–1 400 young ewes plus lambs, and 1 000 wethers. If I buy sheep, I get animals that are about to cut their full teeth as they can handle the tougher country.

I have always classed my sheep heavily with the aim of getting long-bodied sheep with a good square top line. Over the last few years I have classed out the stronger wool sheep. You can't bring the micron down too quickly as you lose the constitution and frame. I have pulled the micron back from 22–24 down to 21. Sheep are classed when they have their first wool clip (12–18 months old), and not as weaners as you get a better idea of their potential and they produce more wool to help pay for shearing.

I don't believe in joining classed sheep until they are two years old as this allows them to grow in frame. I get better results if I join 3–4 weeks after rain that produces some green pick, usually in late December through to February. This provides good nutrition for early development.

Wool follicle development

The development of wool follicles occurs when the foetus is 40–120 days old. Thus poor nutrition of pregnant ewes can lower the total number of follicles formed on the lamb (by up to 15 per cent). As a consequence, potential wool production and wool qualities are permanently lowered throughout the life of the animal.

Tony Williams, NSW Agriculture, 1991.

I don't believe in over-handling sheep

Every time you handle sheep you put them under stress. So I split the sheep up into the paddocks and leave them there unless things are going to get really dry, then I get them out of there.

The less you handle sheep the better.

It is important to maintain your breeding livestock. The returns were there in the old days to allow sheep to be moved around the different properties during major drought (every six years or so). Today with the low wool prices, it's not so economical to agist livestock. You also have to pay to get them there and back again.

The best thing to do is to cut down your numbers by selling some animals before they lose condition. If I am going to cull sheep I don't sell them straight away. I put them on the better country for six weeks, which makes them worth an extra dollar or two at the sales.

Cattle used as a management tool

You can graze cattle in this country, but they are very heavy on water. It can be a costly exercise pumping water around the place. There's only a few cattle out here at the moment. I use the cattle to take the top off the woollybutt so all the dead grass is removed. The cattle graze it down to about 10 cm, so when the rains come the new green growth is accessible for the sheep to graze.

Cattle are often used as a tool for managing vegetation, keeping it in a form suitable for sheep and goats.

Kangaroos are no longer migratory

Kangaroo numbers are more stable than they were 60 years ago. In the old days, you would notice the kangaroos moving in after drought-breaking rains. The red bucks would turn up first and in the next day or two young red bucks, does and pregnant does would turn up. Then all the does with joeys would come in. You don't notice that today. There weren't enough kangaroos to eat all the grass in those days because the water didn't last long enough. With so many livestock waters around now, the kangaroos don't need to move back to the rivers during drought.

We have many more grey kangaroos than red kangaroos out here, even though we are licensed to shoot more reds than greys. The reds like the sweeter country, while the greys tend to stay in the scrub. We used to get kangaroo harvesters in here, but not any more as it doesn't pay them enough.

Desire for alternative kangaroo management strategies

The Nature Conservation Council of New South Wales is generally opposed to the killing of kangaroos, but acknowledges that it may be necessary to cull kangaroos to mitigate property damage. However, the Council does not support the commercialised consumptive use of kangaroos as the mechanism for managing kangaroo populations. Alternative management practices, such as controlling watering points, should be used to reduce kangaroo populations when paddocks are being rested.

Judy Messer, Nature Conservation Council of New South Wales.

Woody weeds

In many areas of the property mulga is now quite thick and is reducing pasture growth. Years ago, the bottom block was very good wether country. The sheep would do better down there than on the sweeter country. It used to be good grass pasture but now it's overgrown with mulga, especially in the mulga creeks and flats.

The carrying capacity of many properties has been gradually reduced as mulga and other woody weeds have encroached into perennial grasslands.

Where there is a fair bit of woody weed like hopbush, punty bush and so on, I have noticed that the coarser grass still grows in there but the sweeter grasses are no longer present. In fact, coarse grass will grow under most woody weeds except for harlequin fuschia bush.

The control of fire has obviously contributed to the spread of woody weeds. Softer (sandier) country seems to respond well to fire. The grass seed mixes into the soil better than in the hard country. If you have a fire go through you are more likely to have seed come through and germinate on the sandy soil. In harder country a lot of seed sits on the surface and doesn't survive.

In some areas mulga trees are infected with insect scale and galls. Quite a few trees are substantially weakened and some trees die as a result. The effects are localised but there may be some hope for the biological control of mulga.

In conclusion, I have seen many changes to this country over the past 50 years, some are explainable, and some are not. But one thing is for certain, to manage this country successfully you have to understand it.

7 Controlling the grazing process

James and Libby Gardiner
Bulgoo, Cobar

For the first few years after moving onto *Bulgoo* perennial grasses and animal production steadily declined due to over-grazing by feral goats, kangaroos and livestock. The recent adoption of a planned grazing strategy together with a run of good seasons has turned things around.

Property size:	28 300 hectares (70 000 acres) (including 8 000 hectares (20 000 acres) of ridge country)
Average rainfall:	325 mm per annum
Enterprises:	wool, sheep meat, goat meat
Livestock numbers:	3 500 sheep, 1 000 domestic goats
Land types:	66% hard red country
	34% soft red country
Waters:	water courses and ground tanks

Key messages from *Bulgoo*

- Planned grazing management was introduced to encourage growth and productivity of perennial grasses.
- One of the keys of planned grazing is that each paddock gets a rest period after it's grazed.
- Windmill grass is used as an indicator plant—sheep are moved when it is grazed to a critical level.
- With planned grazing, some pasture cover is always left (as standing vegetation and litter) to trap rainfall on the ground.
- Over the past few years, the wool cut has increased from 5 to 6 kg per head.
- Kangaroos aren't a problem if tall feed is around the property.

High grazing pressure

When we moved onto *Bulgoo* in January 1977, the property was fully stocked with 7 200 sheep and 400 head of cattle. During the first few years there was a steady decline in perennial grasses and animal production which we believe was primarily due to the practice of set stocking.

In an effort to control woody weeds 4 000 hectares (10 000 acres) of country was chained soon after the 1982–83 drought. The area was then cropped to help pay for the clearing costs. However, native perennial grasses don't like phosphorus fertiliser and, as a result, they are only just coming back in some areas.

Planned grazing in a holistic management framework

A few years ago we changed to holistic management using a form of planned grazing with the aim of encouraging perennial grasses and boosting production. The aim is to graze a paddock at a very high stocking rate for a short period, then move the livestock to the next paddock. The decision to move the sheep is not a set recipe. It involves looking at the current situation, the season, the soil, plants, water and the timing of livestock handling. This is holistic management. However, the central focus is the condition of the pasture and rest from grazing appears to be the critical factor for rehabilitating pastures.

Condition of pastures is the focus of planned grazing.

Grazing is the one thing you can control.

Presently windmill grass (a palatable, commonly occurring species) is used as an indicator plant. When it is grazed to a critical level we move the livestock. It was the first perennial grass to come back, but now we are also noticing bandicoot grass (mulga oats).

Grazing strategies defined

The most commonly practiced grazing strategy in the rangelands is 'set stocking'. Ideally this involves placing a set number of sheep or cattle in each paddock year round. In practice, paddocks may not be continuously grazed but what breaks in grazing occur result more from practical management considerations (such as mustering for shearing, or drought management strategies) rather than a deliberate program of pasture resting. Set stocking is often the only feasible management strategy where properties have only a few large paddocks, where mustering is difficult or costly or where there is a shortage of labour.

Less common are various forms of tactical grazing where livestock are moved from one paddock to another, or off the property, in response to changing seasonal conditions. There are many variations on this theme but all involve attempts to maintain or improve the pasture by providing periods of rest at times when pastures will benefit from removal of grazing pressure. In some instances animals may be run as a single mob and moved between paddocks in response to the growth rate of the pasture—quickly when vegetation is green after rain and more slowly under dry conditions. In other instances livestock may be run in several mobs with individual paddocks rested when seasonal opportunities arise. In all cases, while some guiding management principles may be recognised, day to day management cannot be predetermined but involves a continuous response to changing seasonal conditions.

The 'Holistic Resource Management' system commonly promoted includes forms of rotational grazing plus all aspects of the production system, including human, biological and financial resources.

Ken Hodgkinson, CSIRO, 1992; Ron Hacker, NSW Agriculture, 1993; Alan Savory and Jody Butterfield, Centre for Holistic Management, USA, 1999.

With planned grazing we always leave some pasture cover, as standing vegetation and litter, to trap rainfall in the ground. We now notice that run-off into ground tanks requires exceptional rain events.

With planned grazing, what rain falls on the ground soaks into the ground.

Patches of perennial grass and timber catch run-off and channel it into the ground, enabling pastures to respond to small amounts of rain.

Infiltration and plant cover

Plant cover has an important effect on the infiltration (absorption) of rainfall into the soil. The presence of litter and standing vegetation, and the creation of small soil mounds and air pores through the soil by perennial grasses help trap and channel rainfall into the soil. On hard red soils, for example, even low plant cover of 20 per cent is enough to double the infiltration of a bare soil from 5 to 10 mm per hour.

Richard Greene, CSIRO, 1996.

Currently we run our sheep and goats on 12 000 hectares (30 000 acres). The other 8 000 hectares (20 000 acres) is ridge country from which we harvest feral goats. We have 14 paddocks that vary in size from 240 to 1 600 hectares (600 to 4 000 acres) and we aim to achieve short term stocking rates of five sheep to the acre—which is about 30 times the rated carrying capacity. That gives us the trampling effect that breaks up the hard soil surface to allow water to penetrate and seeds to germinate.

One of the keys to planned grazing is that each paddock gets a rest period after it is grazed. That is the difference between planned grazing and set stocking. If it rains after a dry spell we move the sheep quickly from paddock to paddock—sometimes on a daily basis. That's because plants growing from bare butts are sensitive to grazing. The impact of grazing should be minimal when plants are actively growing, although, they can take more grazing pressure when mature.

It's when grasses are growing and you over-graze them, that's when you do the damage.

The labour requirement for moving sheep is minimal. The sheep know exactly what is going on as soon as you open a gate. With good open country and smaller paddocks the sheep tend to mob up a lot. We don't need to monitor them very often, maybe once a week. You can see all the sheep in half an hour in the smaller paddocks. Having the sheep in a single paddock at any one time is more labour efficient than having a number of smaller mobs spread over a number of paddocks.

Large mobs of sheep may graze pastures more evenly, placing less pressure on the more palatable plant species.

We have turned things around in the three years since taking up planned grazing, but we haven't had a drought since starting. We started conservatively with one sheep to four hectares (10 acres) but subsequently increased to one sheep to two hectares (5 acres). The last three years have been good, so it would be interesting to have a tight year to see how we would get through.

If the pasture is all right the sheep will be all right.

Cross-bred sheep

We currently have 3 500 Merinos, mainly breeders, which we are trying to build up. We normally shear in May, join in January, lamb in June–July and wean at the end of October–early November. All these operations have to fit in with the planned grazing.

All sheep are run in one mob, except at weaning time when lambs are taken off the ewes at 80 days of age and then put back 10 days later. Rams are also separated. In terms of production, the wool cut has gone from 5 to 6 kg per head (a 20 per cent gain) at 21.5 micron. Lambing percentages have increased from 30 to 80 per cent.

There's no money in wool so we are going for meat production. We are crossing the Merinos with Wiltshires, and the Wiltshire ewes are then crossed with White Dorper. The Wiltshire is an old breed of sheep used for meat production that sheds its wool, while the White Dorper is an African fat tail sheep. We'll end up with better carcass quality.

Domesticated goats

In the early 1990s, the property was overrun with feral goats and over 30 000 animals were harvested. An important control measure was the fencing of the tanks in the ridge country to trap the feral goats. There are not as many feral goats left now. Trapped nannies are combined with our breeding nannies.

We started our domesticated goat enterprise a few years ago. Originally we selected the best of the feral bucks to breed from, but we now use Boer bucks. The Boer crosses give bigger and better proportioned animals. The downside is that the kidding percentage is lower than the ferals. The goats are now

domesticated enough that a five-wire fence will stop them. The goats are trained in the cattle yards with an electric fence. Soon we'll have an electric fence all the way around. We plan to expand further into goats over the next four to five years.

At moderate stocking rates, goats, being browsers, don't pressure pasture like sheep.

Kangaroos like short grass

Kangaroos have been a problem in the past, but now that we have tall feed they don't seem to be around any more. Kangaroos can't handle long rank grass, like sheep and goats, because they are not ruminants.

Kangaroos don't like a great big haystack, they go after the short green feed.

Burning small patches

We think the solution to controlling woody weeds is to pull the country with a chain, leave it, then go back in a drought year and burn small patches. You burn the timber on the ground, the resprouting shrubs, and the grass fuel that is underneath. Small areas are targeted by two to three people with drip torches, so it's labour intensive. We can get 90 per cent kill, even with turpentine, and you don't burn the perennial grasses in between the patches of shrubs—that's the beauty of it. Control of seedlings is helped by animal impact and chemical treatment of those plants that do not receive a complete burn.

Biodiversity and productivity

We did not think biodiversity was important until we started planned grazing. The increase of pasture biomass has improved biodiversity and we believe that it is this process that is improving our productivity. We have plants, birds and reptiles that we have never seen before, and the emus and kangaroos help disperse native seed.

Diverse, high yielding pastures are useful for livestock and wildlife.

Biodiversity and grazing

A study conducted at eight sites across the Australian rangelands, including three in the mulga lands, shows that various plant and animal species respond differently to the proximity of water and associated grazing pressure gradients. Around 10–33 per cent of the species (depending on the site and the type of species) appear to be favoured by grazing, increasing in abundance with proximity to water. Another 15–38 per cent of species decrease in abundance with proximity to water. Ten per cent of these plant and animal species were only found at long distances from water where there was no permanent grazing pressure. The remaining species (36–75 per cent) show no obvious response to proximity to water.

Overall, the results suggest that the majority of plant and animal species are either favoured or unaffected by the proximity to water and associated grazing, however, the challenge is to develop management strategies that ensure the persistence of species that decline under grazing.

Jill Landsberg and others, CSIRO, 1999.

The conservation of the full suite of species in the mulga lands requires that at least some parts of the landscape are maintained in a dry state, devoid of permanent artificial waters. This can occur to some degree in parts of large paddocks that are several kilometres from water, but generally this can be best accomplished in Crown reserves such as National Parks. (Ross Blick)

In conclusion, our method of grazing had to change. We accepted change, not for the sake of change but to change for increased production. The process we used for change has provided a powerful way to rehabilitate the land, using livestock as tools which work 24 hours a day, without cost, whilst having the ability to earn income.

8 Good pastures are the key to profit

Alan Lauder
Woodstock, Cunnamulla

Good pastures, with a focus on resting after rain and using salines, are seen as the key to maximising animal production on *Woodstock*.

Property size:	20 300 hectares (50 200 acres)
Average rainfall:	350 mm per annum
Enterprises:	wool, beef
Livestock numbers:	10 500 sheep (including 4 000 lambs), 50 cattle
Land types:	32% Mitchell grass 32% sand hill country 31% sparse gidgee 5% mulga country
Waters:	bore drains

Key messages from *Woodstock*

- Quality pastures and good management can result in an extra 10–20 per cent lambing rate.
- Rest for three to eight weeks after rain increases pasture production by 50–80 per cent.
- Salines are used to supply a source of protein that helps livestock to better utilise dry and frosted feed.
- A recent 10 per cent reduction in livestock numbers had no negative affect on total wool production.

The need for good pastures

I believe in maximising production per animal both in terms of reproduction and wool production. If you have good pastures, ewes are more fertile, sheep mob up more (which aids in joining and mustering), more twins are produced, less lambs

are abandoned and stronger lambs are produced. Strong early development of lambs flows through to larger mature animals with finer wool. Through good pastures and management you can get an extra 10–20 per cent lambing rate. You will have more animals available to class and more animals to sell. Why buy expensive rams and then feed the progeny to 80 per cent of their genetic potential.

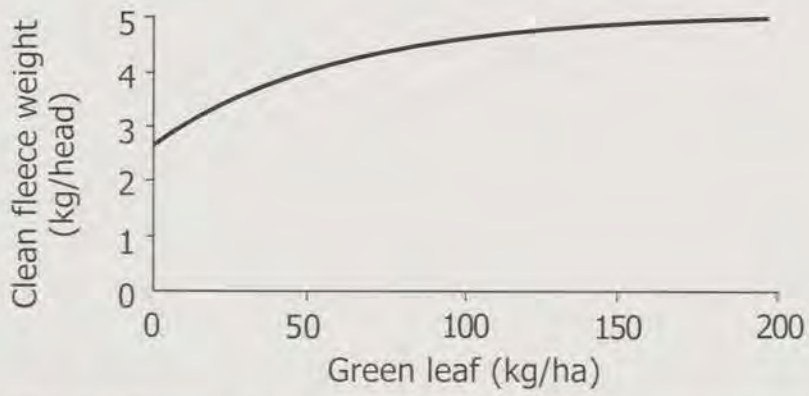
Pastures are our real source of income, not animals. Animals are factories which are more productive with superior genetics.

Healthy perennial grass pastures, like this Mitchell grassland, are the life-blood of many properties in the mulga lands.

Similarly, if it hypothetically costs $10 to run an animal and one animal produces $11 while another produces $12, then a 9 per cent increase in production has resulted in a 100 per cent increase in profit. In an industry with low margins, maximising production per animal through good pastures is critical.

The importance of green leaf

The following graph shows the importance of green leaf on clean fleece production. Wool production (per head) nears its maximum when green leaf supply is as low as 100 kilograms per hectare. Perennial grasses that are in good condition are able to provide this amount of green leaf even under poor seasonal conditions by responding to small falls of rain.



The positive effect of green leaf availability on wool production.

David Freudenberger and others, CSIRO, 1999.

Managing grazing pressure to maintain good pastures

There are a number of techniques that I use to manage the grazing pressure and maintain the pastures in good condition. These include resting pastures after rain, planning animal husbandry around seasonal conditions, maintaining a conservative stocking rate, using salines (saltbush) and managing the kangaroo population.

Resting pastures after rain

Rest from grazing for three to eight weeks after rain increases pasture production by 50–80 per cent and produces greater seed set.

Fencing off inferior country provides an opportunity to rest better pastures and ensure more complete pasture utilisation. For example, a lot of my inferior country is productive when green but livestock graze the best country and then let the inferior country go rank. The sandhills are a perfect example of country that is productive when it is green, and especially so when it is short. If the cattle are forced to graze it by fencing it off, it is kept short and when there is summer rain the sheep can be put on the sandhills to allow the black soil country to regenerate. Likewise the 1 000 hectares (2 500 acres) of mulga was fenced off from the black soil country and used to spell the black soil country after rain. Ewes joined on 'green' mulga grass only had a 2 per cent lower conception rate than those on the black soil country.

A high quality green mulga pasture maintained by management and fencing to country type.

I also employ another method of resting, which would appeal to those who don't want to under-stock to spell country or fence off the inferior country. If one or more paddocks are in good order then over-stock them in a wet year, so that degraded paddocks can be rested. Occasional over-stocking will not harm healthy pastures during good seasons.

Animal management according to seasonal conditions

Animal management is influenced by the seasons. Lambs can not digest dry feed until their stomach develops and, as it is often dry around November, I join in the first week of February and lamb in August. Also, with a winter lambing the ewes do not have the same urgency to walk the long distance into water with a newborn lamb. This joining date allows the lambs to be weaned off their mothers at the January shearing and the male portion sold.

At shearing time all wether lambs, cull two-tooth ewes and cast-for-age ewes are sold. It is important to truck out all sale sheep quickly as they are eating pasture that is needed to produce next year's income. Also, all the sheep can be put into their paddocks for the next six months if sale sheep are trucked at shearing. The ewe lambs are shorn, weaned and mulesed at the same muster.

The other major muster is in June for crutching when the property is again rearranged ready for lambing. The ewe lambs get the best of the feed until the June muster and then the lambing ewes get the best. This way the ewe lambs are on the best feed for the first twelve months of their life to increase their long-term production potential.

Maintaining a conservative stocking rate

I try not to run too many sheep. It doesn't matter how much rain I get, I will not increase my stocking rate. If things get tight I will agist to maintain my ewe base. Five years ago I reduced the stocking rate by 10 per cent and still produce the same number of bales of wool. This reduction allows me to rest pastures after every good rainfall event and means that the sheep are more spread out during dry times. The improvement in perennial grasses and soil structure would now allow me to return the 10 per cent of sheep removed provided tactical resting was continued.

Using salines (saltbush)

The naturally occurring saltbushes have an advantage over grasses and forbs in that they are frost resistant, drought resistant, and are not readily eaten by

Palatable perennial shrubs such as saltbush provide a valuable addition to the diet of domestic livestock.

kangaroos. It acts not as a food source but rather as a protein source that assists livestock to digest dry, frosted grass. If there is little winter rain to grow herbage, I will put the lambing ewes into the saltbush country.

Saltbush plantations can significantly increase the carrying capacity of properties.

In the summers of normal years I have a higher utilisation rate of the grass country and under-stock the saltbush country to rest the salines and encourage more grasses. I am also establishing plantations of Old Man Saltbush as a management tool rather than as a drought reserve.

Managing kangaroos

The property is well-watered with open bore drains, so kangaroos have been difficult to control. The main problems associated with kangaroo harvesting in this area is that it has smaller animals which fall below the harvestable weight restrictions. A few years ago I had a kangaroo harvester living on the property which helped improve his economics. I also put in some graded tracks to allow good access around the whole property.

Like most people, I get frustrated with kangaroos preferring to graze the country in most need of a rest. However, they are more interested in short, fresh, green pick than country that has rank growth and you can use this to your advantage if you can get volume in the pasture.

Similarly, since kangaroos concentrate on green pick produced from isolated storms, the best time to rest pastures is after widespread rain.

In conclusion, it is the pastures that are the real source of income and management of grazing pressure needs to be aimed towards increasing the quantity and the quality of the feed supply, and increasing the population of drought resistant salines.

9 Greater productivity and better pastures from less sheep

Shane (pictured), Kerry and Lisa Smiles
***Westmere*, Louth**

After feeding mulga to support their sheep during a number of drought periods in the 1990's, the Smiles now consider it a better proposition to run less livestock and produce more from each animal.

Property size:	38 000 hectares (94 000 acres)
Average rainfall:	270 mm per annum
Enterprises:	wool, sheep meat, beef
Livestock numbers:	5 500 sheep, 500 cattle (agisted on property)
Land types:	55% soft mulga
	45% flood plains
Waters:	river, pipelines, bores, ground tanks

Key messages from *Westmere*

- By stocking conservatively you can produce more wool from fewer animals. The wool cut has increased from 4.5 to 6.5–7 kg per head.
- Feeding mulga for drought feed is only a short-term option.
- Cross-bred lamb production is an option to supplement wool income.
- Smaller paddocks and smaller mobs allow sheep to be mustered up, dealt with and returned to the paddock all in the same day.

Livestock management

We have a self-replacing Merino flock and don't run any wethers. In the past we would have run 10 000 sheep, but at present we are only running 5 500. We have pulled the numbers back and are now producing more wool off a lot fewer animals. We will be able to do that year in, year out, even in poor seasons. The wool cut has gone from 4.5 to 6.5–7 kg per head over the last two years, although the micron has gone up from 21.5 to 22.5. Lambing has also increased by 10–15 per cent. Several good seasons have also contributed to the higher animal production.

Conservative stocking has proven to be both sustainable and profitable, where fewer sheep yield more wool with lower costs.

We are now producing more wool off fewer sheep.

We believe that once you introduce sheep to a paddock in this country you shouldn't move them around. Sheep get used to a paddock, they know where the water is, where the sweeter country is, know the bounds of the paddock and can manage themselves. If you move them around different paddocks you have to make sure they are going to water and so forth. Sheep can get lost and if they can't find water, they will perish in a corner. There are four or five mobs of ewes here now that wouldn't have seen another paddock since they were lambs.

Over the years we have re-fenced the entire property. We have smaller paddocks than the district average. I prefer smaller paddocks and smaller mobs of sheep. You can muster a mob of approximately 500 sheep to yard, deal with them in a day and put them back that night. There is still some fencing to be done and more waters to be put into existing paddocks.

For financial reasons we do split shearings in March and October. Management wise it's a lot harder to split shear as we have to organise two shearing teams a year. We usually try to join around February–March. If we join at the end of January then we shear and crutch in March and take the rams out at the same time. In October–November we wean the lambs, sell the wether lambs, and cull the older ewes.

Diversification

Next year we will have around 7 000 ewes, of which 5 000 will be joined. We plan to go into cross-bred lamb production in a bigger way because of the state of the wool industry. At the moment we are using Border Leceister rams. The trouble is they are more inclined to get through fences than the Merinos. We can't really finish the lambs off unless we get a good season. It's purely a numbers game—the wool from the ewes goes some way to paying our running costs while lamb is our main income.

Store lambs

The sale of well-bred, first-cross, store lambs delivered to a finisher at about four to seven months of age can provide an alternative source of income for producers in the rangelands. With lamb producer groups and specialist lamb finishers becoming more common, good quality store lambs for finishing to heavy weights have been hard to find. Producers from higher rainfall areas have been exploring the possibility of contracting the supply of store lambs from producers in the rangelands of western NSW. In some cases rams are supplied to the breeder as part of the contract, ensuring the genetic potential of the lambs will suit the target market. Returns per head are likely to be higher for store lambs than surplus Merino hoggets with the advantage of carrying the animals for shorter periods.

Doug Alcock, NSW Agriculture.

We have diversified into lamb production due to low wool prices. Tourism or farm-stay is possible if you have the right infrastructure and if you have the inclination and personality for that kind of thing. Goats are another option but you need to re-fence a lot of country with electric or goat-proof fence which is prohibitive cost wise. You would have to borrow money, which is risky in an uncertain market.

Diversification is important for survival.

Opportunistically stocking cattle

Last year we had some of our own cattle, plus an additional 700 head on agistment on the river flat country. It was very opportunistic as we had 580 mm of rain for the year (1998). Unless we get good seasons, we can't rely on turning off steers. Generally it takes too long to operate a budget and have a management operation around cattle. We are also limited because we can't run cattle on the red soil country, because there is so much rice weed that causes St George disease.

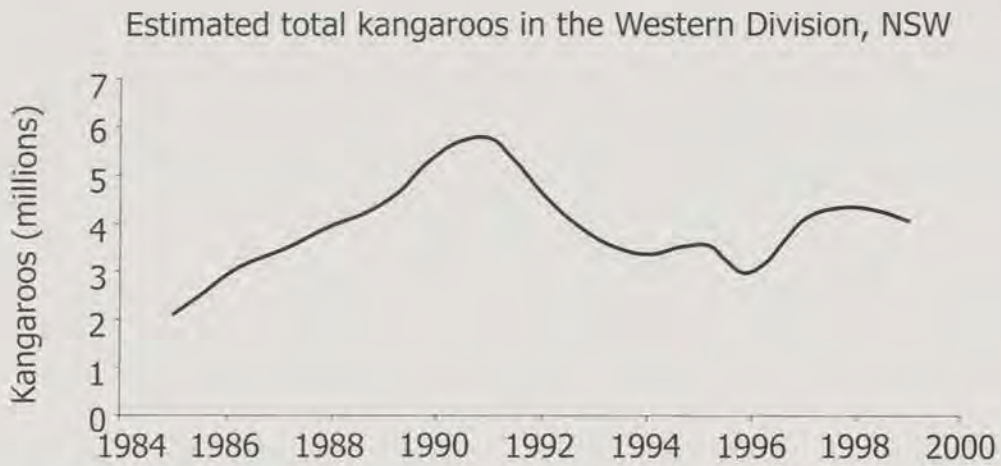
Highly productive river flood plains like those along the Darling River provide valuable grazing opportunities for pastoral enterprises.

Kangaroos

I believe the western and central divisions have 90 per cent of the kangaroos in NSW. Extra watering points have increased kangaroo numbers dramatically above what they have been in the past. Kangaroos are soft pawed animals and they don't affect the country as much as sheep, cattle and goats do. However, they do tear grass out by the roots. Sheep and goats will graze grass to ground level, while cattle leave the butt there.

Kangaroo numbers

The graph below shows how kangaroo populations respond to seasonal conditions. In 1985 the population was depressed to 2 million following the drought of the early 1980s. In response to improved seasonal conditions the population rose to about 6 million in 1991 but then dropped away again due to dry conditions in 1992–93. Since 1994, the population has fluctuated only slightly.



Kangaroo population estimates for the Western Division of NSW (1985–1999), based on the Tibooburra, Cobar, Bourke, Lower Darling and Broken Hill kangaroo management zones.

Joshua Gilroy, New South Wales National Parks and Wildlife Service, 1999.

During the last major wet period in 1988, there was a major explosion in kangaroo numbers. We had four blokes shooting professionally out here on the property, and they could not keep up with the numbers. Today there is one full-time and one part-time licensed kangaroo harvester on 800 000 hectares (2 000 000 acres) in the whole district.

Feral goats

The upturn in the feral goat industry is one of the best things to happen to the Western Division.

Goats have been a nice little earner in the last five to six years. The feral goats have been cleaned up and the country has come back. As there are not many goats left, I muster them up with dogs and a trailer. The trailer is a good way to remove those last remaining goats and earn a bit of extra cash.

The decline of feral goats

Feral goats eat a greater diversity of plant material from a wider range of canopy heights than many other herbivores, and unless their numbers are kept in check they will destroy nearly all vegetation in arid areas and at the same time prevent its regeneration.

Domestic goats managed at proper stocking rates in correctly fenced paddocks with adequate feed, water and shelter, should have less environmental impact than uncontrolled feral goats. However, the management of domestic goats in the mulga lands is relatively new, and at this time little information is available on stocking rates and grazing management practices that suit particular seasons and locations.

There is a need to closely monitor domestic goats as they have an ability to utilise many trees and shrubs that are unavailable and/or unpalatable to sheep and cattle, and therefore have the potential to be more damaging to arid zone perennial vegetation and soils. This potential is more likely to be realised during drought, when generally speaking goats in the arid zone survive well.

Brian Toseland, Goat Industry Council of Australia, 1992; Robert Henzell, South Australia Animal and Plant Control Commission, 1992.

Drought management decisions

During the 1991 drought, we took the livestock off the country in phases. We could see the country was going backwards. We started feeding mulga in one area, and brought animals there as the country deteriorated. The red soil country deteriorates quicker than the black soil country. By running less animals you can have more flexibility in times of drought. The only problem is that the kangaroos compete for feed. Some areas are thick with kangaroos. You want the best for your country and your sheep but sometimes it is out of your control.

If I have to make a decision about destocking due to drought, the most difficult thing that can happen is to get 10 to 15 mm of rain. All of a sudden you think you have another month of feed. In actual fact you haven't. Sheep lose condition chasing the green pick that isn't there (very short green shoots that can't be eaten) and go off the harder seeds (clover) and dry grass that is available. You need to make a tentative date in the future to take some kind of action. If you get a small fall of rain you have to bring that date closer and start looking for agistment or sell livestock to lighten numbers.

Feeding mulga

We fed mulga during the drought periods of 1991–95. We wouldn't like to do that again. We carried 9 000 sheep and may have lost a total of 10 per cent. The losses in 1991 would have been much higher without feeding mulga. You have to put the mulga onto the ground so the leaf material is accessible to the sheep, otherwise they get mulga balls in their stomachs from eating too many twigs. Sheep that are born and bred under mulga can survive off the leaf, but you will always lose a few along the way. You certainly can't lamb on mulga—they have to be dry sheep.

Mulga shrubs and trees lying on the ground trap run-off and provide excellent sites for the regeneration of perennial grasses. The spiky branches then protect these new plants from grazing while they become established.

On the current financial returns from wool there is no way we could afford to feed mulga again over a long period. It can be a big commitment continually feeding mulga to livestock over a long dry period.

We would only consider feeding mulga again for short periods. For example, I would feed prior to shearing, if the animals were losing condition to get them up to shearing. We would then look at agisting or selling them. I would only agist the ewes and rams, and sell off the old and dry sheep. With lambs, even if you had to sell those lambs while they're on agistment you're still making money. If you shear them before they go, the break in the wool isn't as much. The fewer operations you have to do while you're away on agistment the better. We have agisted 3 000 ewes in the past. Even with low wool prices at the moment I would consider agisting ewes—selling lambs would cover the agistment costs. If you have a quality mob of ewes, you can't buy back that quality.

In conclusion, our primary goal is to be profitable at the end of the year—first and foremost you have to be financially viable. At the same time you have to be running your country conservatively so that you can operate into the next year.

The property was quite successful until the collapse of the wool market in 1990. If you add the high interest rates and drought it's a difficult cocktail to swallow. But we have turned things around in the last five years and are heading in the right direction, especially considering the current commodity prices.

10 Improving country by under-stocking after rain

James and Sue Stirton
***Armoobilla*, Cheepie**

A focus on under-stocking after good rain has improved the country on *Armoobilla*, which now has more grass and a greater capacity to respond to small amounts of rain.

Property size:	44 000 hectares (109 000 acres)
Average rainfall:	380 mm per annum
Enterprises:	wool, beef
Livestock numbers:	7–8 000 sheep, 350 cattle
Land types:	40% soft mulga
	35% creeks and flats
	25% hard mulga
Waters:	dams, creek and bore

Key messages from *Armoobilla*

- Under-stocking after good rain has allowed the country to grass up which means it is now better able to respond to small falls of rain.
- Fenced dams allow for self-mustering which can result in savings of one man's wages for two to three weeks.
- A decision about whether to increase, decrease or maintain livestock numbers is made by March and is largely dependent on the rainfall received over the summer.

Under-stocking after good rain

My father bought *Armoobilla* in 1957 but by the 1960s we began to realise that the 32 000 hectare property could not support the original numbers of 8 000 sheep and 400 head of cattle. Our problem was that we never had any grass on the ground. We were always behind the eight ball—always feeding scrub and always running into droughts quicker and getting out of them later.

It was a combination of circumstances after the 1992 drought that turned things around. We had good rains, our livestock numbers were down and we made the decision not to increase numbers for the next 12 months. The place really grassed up well and since then our country has been better able to respond to small falls of rain. We don't know how you put it down in dollars but it has certainly paid dividends for us.

The most important thing is to have your place under-stocked after good rain so you can get grass growth and establishment.

Pastures that are weakened during drought benefit from being rested when the rains eventually come. They are then better able to withstand subsequent grazing and periods of little rainfall.

Benefits of resting grasses after rain

Resting perennial grasses after good rainfall has several benefits. Firstly, substantially more growth can occur in the absence of grazing. Resting prevents grazing animals nipping off the young tender shoots of perennial grasses that have remained dormant until the rains came. This allows the grasses to rejuvenate their energy reserves and develop deep, extensive root systems to help them survive the next inevitable dry spell. Even one or two weeks of rest after rain can allow grasses to shoot away without being set back by grazing.

Flowering and seed set also occurs at certain times of the year in response to rainfall. Grazing at these times significantly reduces production of seed and it is the scarcity of seed that often limits the establishment of preferred plants in the pasture.

Ken Hodgkinson, CSIRO, 1992.

Adjusting livestock numbers to feed availability

In terms of annual adjustments to livestock numbers we usually make a decision by March about whether to reduce livestock numbers, build them up or leave them around the same. This decision is based largely on the rainfall received over the summer. If things get particularly dry, we would push scrub. We'd concentrate on one paddock and then, when it does rain, continue to push scrub in there until the rest of the place comes away. Then we'd take everything out of there and leave it until it recovers.

Pasture budgeting and utilisation

Grazing trials in south-west Queensland found that 80–90 per cent of the forage grown annually is produced between October and March. A safe stocking rate for the year can be determined at the end of this growth season, based on the amount of feed then available. It was found that stocking rates that used 20 per cent of the feed available at the end of March resulted in higher quality pastures and equal wool production compared with more heavily utilised pastures.

Mike Sullivan and others, DPI, 1986.

The control of woody weeds in selected areas can also increase the productivity of that area over time. We had a paddock that was 5 600 hectares (14 000 acres) and it used to run 400 wethers. We pulled about one third and are now able to run 1 000–1 200 wethers due to the increased amount of natives grasses now growing in that paddock. Because animals will concentrate on the sweeter pulled country the pressure is reduced on the patches of native grass that were previously heavily grazed. This means that better management of mulga can contribute to the recovery of native perennial grasses across the entire paddock.

The combined effects of competition from thick mulga regrowth and grazing, places high pressure on perennial grasses.

The thinning of mulga regrowth has resulted in more widespread and vigorous grass growth, which is more productive and diverse.

Mulga regrowth, perennial grasses, and biodiversity

The mulga lands of the Murray-Darling Basin have many areas of thick mulga regrowth. In the absence of fire to control mulga regrowth, large areas of 'whipstick' mulga—that is dense low mulga shrubs—have sprung up to such a thickness that the native perennial grass cover has been suppressed. This lack of perennial grass cover leads to soil erosion, and supports only a limited range of native flora and fauna.

John Cameron, Consulting Resource Economist, 1991; Ross Blick, Australian Conservation Foundation, 1991.

Stocking strategy

We use a set stocking strategy on *Armoobilla.* We'll generally put sheep in a paddock and leave them there for 12 months and do the same again next year. Sometimes we'll load a paddock up more than normal and lighten another one off but there'll still be sheep in there. We shear in December so we start mustering in mid-November, starting with the paddocks further out. If we get rain in those paddocks before we put the sheep back, we'll hold the sheep in a bit. Usually by the end of January all the paddocks, except those that are being rested after pulling, have livestock in them. The exception is the cattle that are run in the creek from the end of December through until weaning in May–June. After that they go out to the bigger paddocks. We have always used the set stocking strategy because it works well for us.

Controlled waters for self-mustering

Some of our dams are fenced and we use these for mustering sheep. We can probably muster about 70 per cent of the place by shutting off the waters, provided it doesn't rain. That's why we shear in December—because October and November are usually two of our driest months in the year. We start in the paddocks that are furthest out and bulk the sheep up into easier-to-muster paddocks. Usually we'll get a gyrocopter to help muster the last few paddocks.

Using the trap yards to muster for shearing saves us one person's wages for two to three weeks.

Eventually we hope to get all of the waters fenced off. Landcare and Riverreach have helped in the fencing of Beechal Creek. The fencing will help to care for the creek and by fencing off let-ins (allowing access to the creek) and putting in mills and troughs we will be able to better control livestock access to waters. Once the creek and the three remaining dams are fenced I can virtually manage the mustering on my own, with only limited help.

Some of the fenced dams are also goat-proof (six-line hinged joint with two barbs plus a plain wire top and bottom to tie the hinged joint to) and we recently used the set-up to muster feral goats. After noticing goats coming and going to the water we made some adjustments to the gates so goats could push into the yard but not get out. We went out the next day and collected 30 goats from one watering point. It's a pretty simple way of doing a job that would normally take half a day.

Self-mustering traps provide a cost-effective mechanism for mustering sheep, cattle and feral goats.

Self-mustering of goats

The capture and sale of feral goats is quite profitable, as the average mustering cost of $2 is well below their current market price. This means that the 2 to 4 per cent of the year spent mustering goats by graziers in south-west Queensland is time well spent.

Mustering costs using a combination of motor bikes, dogs and an aeroplane averaged out at $1.90 per head, but ranged from $0.40 to $7.40 for individual musters. This large range in mustering costs was mainly due to differences in the numbers of goats captured during each harvest event. Labour was the largest component of mustering costs, making up around half of the total costs.

The costs of trapping goats on waters were similar, averaging $2.10 per head. However, the actual cost of operating a trap was only $0.60, much of which was labour. The remaining cost of $1.50 per head was for materials and labour used in the construction of trap yards. These mustering costs will be substantially reduced if the same traps are also used for mustering sheep and cattle.

Jim Thompson and others, DNR, 1999; Peter Connelly and others, DPI, 2000.

Kangaroos

In terms of kangaroos, we've never really considered them to be a big problem. We do have a kangaroo harvester who comes out once a fortnight but I wouldn't say there has been any reduction in numbers. In fact, we'd have more kangaroos here now than we've ever had. That may be because we've got a lot more grass. The kangaroos are eating some of the feed but they're generally dispersed when the season is good. They don't cause major problems unless the season is dry or paddocks that are locked up receive rain.

In conclusion, under-stocking after rain, resting sacrifice areas used for scrub pulling and controlling waters are some of the methods used to manage total grazing pressure on *Armoobilla*.

Common themes in managing mulga country

While there is no single 'right way' of managing grazing in mulga country, there are a number of themes that appear common to grazing enterprises.

Grazing for profitability and sustainability

Graziers are there for the long term, and their goals include both economic viability and ecological sustainability. Peter and Mary Bryant sum this up particularly well. *'Our aim in managing the land is to provide ourselves with a reasonable living, consistent with the capability of the land. First of all we're looking after ourselves, we want to grow a good product, we want to be proud of what we grow and we want to maintain the resource that we've got.'*

Kerry and Shane Smiles expressed similar sentiments. *'Our primary goal is to be profitable at the end of the year—first and foremost you have to be financially viable. At the same time you have to be running your country conservatively so that you can operate into the next year.'*

Management of grazing needs to be flexible

Graziers often voice the need for flexibility in the face of climatic and economic variability. Alan and Jacki Cooney expressed strong feelings about the need for a flexible approach to the management of grazing.

'I really object to any formalisation of the management strategy. It has to be flexible. You weigh up your requirements and the resources that you have available and you try and balance them out as best you can. It has to be done on individual properties, considering the individual circumstances and those circumstances can change every day. Basically, you've got to be responsive to the circumstances you find yourself in.'

Peter and Mary Bryant also felt that it was important not to apply hard and fast rules to the management of grazing, but rather assess each situation as it arises.

Sustainability through conservative stocking

Conservative stocking is regularly used to maintain and improve pastures. *'I try not to run too many sheep. It doesn't matter how much rain I get, I will not increase my stocking rate'* (Alan Lauder).

Similarly John and Sharon Blease said: *'This is delicate country so you have to respect it—you can't over-stock it.'*

Graziers often run less livestock than their country is capable of supporting. This provides them with a number of benefits:

- *'even in good seasons we try to keep a lid on the numbers to allow the country to recover a bit'* (Peter and Mary Bryant)

- *'by running less livestock on more hectares you can have more flexibility during droughts'* (Kerry and Shane Smiles)
- *'generally, no major changes are made to livestock management during the good seasons, as those years are used to build up a good seed bank or fuel for a burn'* (Graham and Merrita Baker)
- *'the most important thing is to have your place under-stocked after good rain so you can get grass growth and establishment'* (James and Sue Stirton).

Conservative stocking resulting in productive livestock and healthy pastures.

Improving pasture production through resting

Resting paddocks for varying periods was also commonly practiced by graziers to improve the condition of their native pastures. The most common form of rest was for a period of a few weeks immediately after good rain. Neil and Lyn Cadzow take advantage of the February shearing to concentrate livestock in one paddock. *'There's normally good rain around the end of February, and the absence of animals in those paddocks gave the pasture a chance to get away and go to seed.'*

Alan and Jacqui Cooney employ a unique strategy at *Turn Turn* involving three types of rest. They apply a short-term rest immediately following beneficial rain using paddock pairs; a seasonal rest that lasts for around four months during dry times; and a long-term rest of up to two years.

James and Libby Gardiner believe that a key component of their planned grazing strategy is the period of rest. *'If it rains after a dry spell we move the sheep quickly from paddock to paddock—sometimes on a daily basis. That's because plants growing from bare butts are sensitive to grazing.'*

Alan Lauder has also observed substantial benefits from resting pastures after rain. *'Rest from grazing for three to eight weeks after rain increases pasture production by 50 to 80 per cent and produces greater seed set.'*

Managing vegetation with fire

Wild fire was a common feature of the mulga lands prior to pastoralism and helped to keep shrubs in check and maintain open woodlands. Today the frequency and extent of fire is limited by domestic, native and feral grazing animals that remove grass fuel, and by fire fighting and fire restrictions. *'The control of fire has obviously contributed to the spread of woody weeds.'* (Allan Crawford)

Controlled burning can be used to kill encroaching shrubs that suppress the growth of perennial grass.

Peter and Mary Bryant have also observed an increase in the amount of scrub on their property, and believe that fire is the most economical way of controlling it. Graham and Merrita Baker found that burning during spring achieved good results in the control of woody weeds, particularly turkey bush, sandalwood and regrowth from poplar box.

Neil and Lyn Cadzow use fire on *Alice Downs* for several reasons. *'Burning is useful in clearing pulled timber for better access, controlling regrowth, clearing old grass to allow for fresh new growth and in providing a seedbed for the planting of improved grasses. However, fire can have damaging effects if not managed correctly. For example, a fire that is too hot may result in scalding of the soil surface and stocking too soon after burning can damage pastures and lead to erosion.'*

Selling and agisting livestock in the dry years

A number of strategies are employed to cope with dry seasons and droughts. Conservative stocking is commonly used to provide the 'haystack' of dry grass to carry livestock through dry seasons. During extended dry periods when feed is in short supply, livestock numbers are reduced by selling or agisting. Kerry, Shane and Lisa Smiles aptly describe this situation.

'We would only consider feeding mulga again for short periods. For example, I would feed prior to shearing, if the animals were losing condition to get them up to shearing. We would then look at agisting or selling them. I would only agist the ewes and rams, and sell off the older and dry sheep. With lambs, even if you had to sell those lambs while they're on agistment you're still making money. If you shear them before they go, the break in the wool isn't as much. The fewer operations you have to do while you're away on agistment the better. We have

agisted 3 000 ewes in the past. Even with low wool prices at the moment I would consider agisting ewes—selling lambs would cover the agistment costs. If you have a quality mob of ewes, you can't buy back that quality.'

Allan Crawford believes that in dry years the best thing you can do is to cut down your numbers by selling some animals before they lose condition. *'If I am going to cull sheep I don't sell them straight away. I put them on the better country for six weeks, which makes them worth an extra dollar or two at the sales.'*

Selling and agisting livestock during dry times are strategies that have improved the long-term sustainability and profitability of some grazing properties.

Some insight into an impending feed shortage can be gained by pasture budgeting at the end of the growing season. In the Charleville area, the number of livestock that can be safely carried through the year can be determined from the amount of feed available in March. *'In terms of annual adjustments to livestock numbers we usually make a decision by March about whether to keep the numbers down, build them up or leave them around the same. This decision is based largely on the rainfall received over the summer.'* (James and Sue Stirton)

Domestication of the feral goat

An increase in the value of feral goats has seen the harvest effort intensify and the number of goats drop. *'The upturn in the goat industry is one of the best things to happen to the Western Division of NSW. Goats have been a nice little earner in the last five to six years. The goats have been cleaned up and the country has come back.'* (Kerry and Shane Smiles)

In many cases the previously uncontrolled feral goats have now been captured, and either sold to the meat works or domesticated. *'In the past, feral goats had*

been mustered and sold whenever the opportunity existed. Although the number of feral goats on the property has significantly declined, we will continue to harvest and domesticate them.' (Graham and Merrita Baker)

A number of graziers have suggested that domestic goats at moderate stocking rates have less impact on pastures than sheep. *'We find that at moderate stocking rates goats are softer on the country than sheep. When it rains sheep live entirely off the ground, while goats will browse, and do not graze grasses as short as sheep.'* (John and Sharon Blease)

Managing kangaroo grazing pressure

In the good seasons graziers tend not to be concerned with kangaroos, as there is usually plenty of feed for all animals.

'In terms of kangaroos, we've never really considered them to be a big problem. We do have a shooter who comes out once a fortnight but I wouldn't say there has been any reduction in numbers. In fact, I think we'd have more kangaroos here now than we've ever had. The kangaroos are eating some of the feed but they're generally dispersed when the season is good. I don't think they cause major problems unless the season is dry or paddocks that are locked up receive rain.' (James and Sue Stirton)

Total grazing pressure should be controlled at critical times such as during and immediately after droughts.

Kangaroos tend to increase during a run of wet years, and decline quickly during droughts. Licensed harvesters are used to control numbers when the population is seen to increase. *'During the last major wet period in 1988, there was a major explosion in kangaroo numbers. We had four blokes shooting professionally out here on the property, and they could not keep up with the numbers.'* (Kerry and Shane Smiles)

Some limited options are available for managing outbreaks of kangaroos. Kangaroos can be persuaded to graze elsewhere by retaining long rank grass (Alan Lauder, James and Libby Gardiner), and by closing waters (Alan and Jacki Cooney). The Cadzows, Cooneys and Bakers also direct harvesters to rested paddocks or burnt areas where kangaroos are congregating, resulting in more efficient harvesting.

Native pastures link productivity and biodiversity

The majority of grazing properties in the mulga lands rely on native pastures in native woodlands. Like the native fauna, the long-term survival of graziers is dependent on the conservation of natural plant communities. For this reason productivity and biodiversity in the mulga lands are intricately linked.

Graham and Merrita Baker, and James and Libby Gardiner observed that increases in the biomass of grass led to improvements in both the productivity and biodiversity of their country. *'The increase of pasture biomass has improved biodiversity and we believe that it is this process that is improving our productivity.'* (James and Libby Gardiner)

Conservation of wildlife like this yellow-footed rock-wallaby is compatible with grazing enterprises in the mulga lands.

In the mulga lands pastoralism is part of and dependent on the natural environment and its biodiversity. They go hand-in-hand.

Marketing of environmentally friendly pastoralism

The rangelands are uniquely placed to conserve native flora and fauna, and entire ecosystems. While pastoral activities have altered these natural systems, it is still possible to carry out pastoral production within landscapes that are recognisable for what they once were. In few other forms of primary production is the potential for nature conservation as compatible with the potential for economic production.

Ron Hacker, NSW Agriculture, 1992.

Pastoralists from the mulga lands are well situated to take advantage of consumer markets that demand environmentally friendly meat and fibre products. Certification schemes that include the principles of *Ecologically Sustainable Development* (ESD) are used to assure customers of the environmental credentials of products. Market premiums for certified products would provide a strong incentive for pastoralists to pursue long-term environmental goals.

Judy Messer, Nature Conservation Council of New South Wales.

Sustainable use through knowing and reading the country

Sustainable use of grazing properties in the mulga lands requires the application of a great deal of ecological and pastoral knowledge. Much of this could not be borrowed from other agricultural regions, and hence pastoralists in the mulga lands have developed 'banks' of local knowledge on how to be sustainable.

As shown in the comment boxes of this publication, scientists have also studied the mulga lands for several decades, and now have a good understanding of the components and interactions of this natural ecological system.

Graziers and scientists are now combining their experience, knowledge and skills to guide the management of total grazing pressure in the mulga lands. While there is no single 'right way' of managing grazing in mulga country, one thing is certain, the key to sustainable use of the mulga lands is knowing and reading the country, and adapting management practices to suit ever-changing situations.

Graziers and scientists are finding that much can be learnt from each other about the nature and use of the mulga lands.

References

Barker, R.D. 1987. The diets of herbivores in the sheep rangelands. pp. 69–83. *Kangaroos: their ecology and management in the sheep rangelands of Australia.* Editors: G. Caughley, N. Shepherd, and J. Short. Cambridge University Press.

Booth, C.A., Sanchez-Bayo, F. and King, G. W. 1996. Establishment of woody weeds in western New South Wales. 2. Growth and competitive potential. *Rangeland Journal* 18:80–98.

Burgess, D.M.N. 1988. The economics of prescribed burning for shrub control in the semi-arid woodlands of north-west New South Wales. *Australian Rangeland Journal* 10:48–59.

Burrows, W.H. 1986. Potential ecosystem productivity. pp. 7–10. *The Mulga Lands.* Editor: P. Sattler. Royal Society of Queensland. Brisbane.

Buxton, R. and Stafford Smith, M. 1996. Managing drought in Australia's rangelands: four weddings and a funeral. *Rangeland Journal* 18:292–308.

Cameron, R. and Blick, R. 1991. Case study 2: Pastoralism in the Queensland mulga lands. pp. 75–115. *Recovering Ground.* Editors: J. Cameron and J. Elix. Australian Conservation Foundation, Melbourne.

Clarke, M.R. 1987. Beating drought in mulga country cattle herds. *Queensland Agricultural Journal.* May-June 1987:181–183.

Connelly, P., Horrocks, D., Pahl, L. and Warman, K. 2000. *Self-mustering enclosures: cost effective and multi-purpose.* Department of Primary Industries, Queensland, Brisbane.

Cowley, R. 1998. Nature conservation issues in the South West Strategy area: discussion document. Department of Natural Resources, Queensland.

Freudenberger, D. and Hacker, R.B. 1997. The effect of short-term exclosure of watering points on the behaviour and harvesting efficiency of grey and red kangaroos. *Rangeland Journal.* 19:145–156.

Freudenberger, D., Wilson, A. and Palmer, R. 1999. The effects of perennial grasses, stocking rate and rainfall on sheep production in a semi-arid woodland of eastern Australia. *Rangeland Journal.* 21:199–219.

Greene, R.S.B., Kinnell, P.I.A., and Wood, J.T. 1994. Role of plant cover and stock trampling on run-off and soil erosion from semi-arid wooded rangelands. *Australian Journal of Soil Research.* 32:953–973.

Hacker, R. 1992. Expectations for Australia's rangelands: a personal view. pp. 6–9. *Proceedings of the National Workshop on Feral Goat Management: planning for action.* Editor: D. Freudenberger. Bureau of Resource Sciences, Canberra.

Hacker, R. 1993. A brief evaluation of time control grazing. pp. 82–89. *Proc. Eighth Annual Conference. Grasslands Society of NSW.*

Harrington, G.N., Mills, D.M.D., Pressland, A.J. and Hodgkinson, K.C. 1984. Semi-arid woodlands. pp. 189–207. *Management of Australia's Rangelands.* Editors: G. N. Harrington, A. D. Wilson, and M. D. Young. CSIRO, Melbourne.

Henzell, R. 1989. *Proclaimed animal research in South Australia – cost-benefits, future directions and related issues.* Animal and Plant Control Commission, South Australia.

Henzell, R. 1992. The ecology of feral goats. pp. 13–20. *Proceedings of the National Workshop on Feral Goat Management: planning for action.* Editor: D. Freudenberger. Bureau of Resource Sciences, Canberra.

Hodge, R.W. 1991. Weaner Management. pp. 164–173. *Australian Sheep and Wool Handbook.* Editor: by D. Cottle. Inkata Press. Melbourne.

Hodgkinson, K.C. 1991. Shrub recruitment response to intensity and season of fire in a semi-arid woodland. *Journal of Applied Ecology*. 28:60–70.

Hodgkinson, K.C. 1992. Elements of grazing strategies for perennial grass management in rangelands. pp. 77–94. *Desertified Grasslands: Their Biology and Management.* Editor: G. P. Chapman. Academic Press. London.

Hodgkinson, K.C. 1993. Identification of critical thresholds for opportunistic management of rangeland vegetation. pp. 127–129. *Proceedings IVth International Rangeland Congress*, April 1991, Montpellier, France.

Hodgkinson, K.C. 1998. Sprouting success of shrubs after fire: height dependent relationships for different strategies. *Oecologia* 115, 64–72.

Holmes, W. 1986. Economic aspects of mixed sheep cattle grazing in western Queensland mulga. pp. 103–107. *The Mulga Lands.* Editor: P. Sattler. Royal Society of Queensland. Brisbane Qld.

Landsberg, J. and Stol, J. 1996. Spatial distribution of sheep, feral goats and kangaroos in woody rangeland paddocks. *Rangeland Journal*, 18:270–291.

Landsberg, J., James, C.D., Morton, S., Hobbs, T.J., Stol, J., Drew, A., and Tongway, H. 1999. The effects of artificial sources of water on rangeland biodiversity. Final report to Environment Australia. Biodiversity technical paper, No.3. CSIRO, Wildlife and Ecology.

Partridge, I. 1996. *Managing mulga grasslands: a graziers guide.* Department of Primary Industries, Queensland. Brisbane.

Pople, A.R. 1996. *Effects of harvesting upon the demography of red kangaroos in western Queensland*. Ph.D Thesis, University of Queensland.

Rose, A. 1998. *The economics of stocking strategies in south west Queensland: an overview of current knowledge*. Dept. of Natural Resources, Charleville, Qld.

Savory, A. and Butterfield, J. (1999). *Holistic management: a new framework for decision making.* Island Press, Washington, D.C.

Silcock, R. 1986. Agriculture in mulga country: the impact of clearing and pasture sowing. pp. 54–57. *The Mulga Lands.* Editor: P. Sattler. Royal Society of Queensland. Brisbane.

Silcock, R. and Smith, F. 1990. Viable seed retention under field conditions by western Queensland pasture species. *Tropical Grasslands* 24:65–74.

Sullivan, M.T., Day, J.R., Clarke, N.R. and Dunlop, L.B. 1986. Management to sustain animal productivity and stability in the mulga zone. pp. 98–102. *The Mulga Lands.* Editor: P. Sattler. Royal Society of Queensland. Brisbane.

Thompson, J., Riethmuller, J., Kelly, D., Boyd-Law, S. and Miller, E. 1999. *Feral goat management in south-west Queensland.* Final Project Report. Dept of Natural Resources, Qld.

Tongway, D.J. and Ludwig, J.A. 1997. The conservation of water and nutrients within landscapes. pp. 13-22. *Landscape Ecology, Function and Management: Principles from Australia's Rangelands.* Editors: Ludwig, J., Tongway, D., Freudenberger, D. Noble, J. and Hodgkinson, K. CSIRO, Australia.

Toseland, B. 1992. Goats are a resource—an industry perspective. pp. 28–37. *Proceedings of the National Workshop on Feral Goat Management: planning for action*. Editor: D. Freudenberger. Bureau of Resource Sciences, Canberra.

Williams, A.J. 1991. Wool Growth. pp. 224–242. *Australian Sheep and Wool Handbook.* Editor: D. Cottle. Inkata Press. Melbourne.

Wilson, B.A. 1997. Compatibilities and conflicts between production and conservation in Queensland's mulga land biogeographic region. pp. 107–14. *Conservation Outside Nature Reserves*. Centre for Conservation Biology, University of Queensland, Brisbane.

Wilson, B.A. and Egan, S.A. 1996. *Model for bioregional management: mulga lands south-west Queensland*. Final report to the Australian Nature Conservation Agency for Phase 1 of the National Reserve Systems Cooperative Project N302. Department of Environment, Brisbane.

Wynne, B. 1992. *Economics of stocking rates in the semi-arid rangelands of NSW.* Economic Notes. Department of Conservation and Land Management.

Further reading

Baker, A. *Challenging your management options.*

Produced with input from a wide range of people in south-west Queensland this book provides practical tips and information on all aspects of the grazing enterprise—includes people, marketing, pastures, book keeping and animal husbandry.

Brooke, G. and McGarva, L. 1998. *Glove box guide to plants of the NSW rangelands.* NSW Agriculture, Australia.

This compact guide book provides help in identifying 127 of the more common grasses, forbs and shrubs of the NSW rangelands. It also provides information on the habitat, distribution and palatability of each species.

Carmen, K., Heywood, J., Pahl, L. and Marsden, S. 1998. *Graziers' perceptions of total grazing pressure in the mulga lands of the Murray-Darling Basin.* Department of Primary Industries, Queensland.

A two part survey report. Part A documents the signs used and management actions taken to monitor and manage total grazing pressure in the mulga lands. Part B provides background information on the properties covered by the survey.

Cameron, J.I. and Elix, J. 1991. *Recovering ground: a case study approach to ecologically sustainable rural land management.* Australian Conservation Foundation, Melbourne.

This report examines the application of the concept of ecological sustainability to Australian rural land management. Of particular relevance is a case study on pastoralism in the Queensland mulga lands and a chapter on land degradation and wild harvesting of kangaroos.

Campbell, T. and Hacker, R. 2000. *The glove box guide to tactical grazing management of the semi-arid woodlands.* NSW Agriculture.

This book contains a number of simple field techniques which graziers can use to better assess their pastures and animals, and then decide how to manage grazing to maintain or improve the long term productivity of their pastures.

Page, M.J. and Beutel, T.S. 1995. *Ecological research and management in the mulga lands: conference proceedings.* University of Queensland, Gatton College.

Proceedings of a conference held at The University of Queensland, Gatton College, 5-6 July 1994. Papers cover a wide range of topics and examine the results of recent research in the mulga lands and the implications for management.

Sattler, P.S. 1986. *The mulga lands.* Royal Society of Queensland, Brisbane.

Proceedings of a symposium held in Brisbane, 18-20 November 1985. Papers are arranged into five sections covering mulga (a description), land use and its implications, management for sustainability of the ecosystem, nature conservation and land administration.

Tropical Grasslands. The mulga lands of Australia: symposium. Charleville, Queensland, August 22-24, 1972. Volume 7 1973.

Documents 22 papers presented at the symposium. Topics focus on ecology, plant physiology, grazing management and animal production in the mulga lands environment.

Graziers' experiences in managing mulga country is a unique presentation of the accumulated experience of 10 grazing families, some of whom have been managing pastoral properties in mulga country for decades.

Not only are the case studies written in graziers' own words, but the inspiration for this book also came from them. They believed that as they spoke the same language and experienced the same challenges, they would benefit from each other's knowledge and practices.

Graziers' experiences in managing mulga country describes how experienced graziers manage for profitability and sustainability. Critical issues include their choice of livestock, stocking rates, grazing and husbandry practices, improvement of native pastures, domestication of feral goats, and control of kangaroos. This is supplemented by knowledge arising from scientific research.

While there is no single 'right way' of managing grazing in the mulga lands, the key is to know and continually read the country, adapt management practices to suit ever-changing conditions, and share the experiences of others.

ISBN 0-7345-0117-X
9 780734 501172

Queensland Government
Department of Primary Industries
NSW Agriculture
MURRAY-DARLING BASIN COMMISSION
CSIRO