



The Australian Rangeland Society

RANGE MANAGEMENT NEWSLETTER

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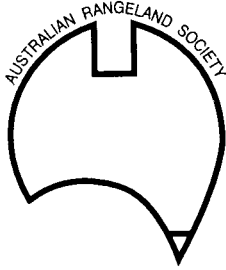
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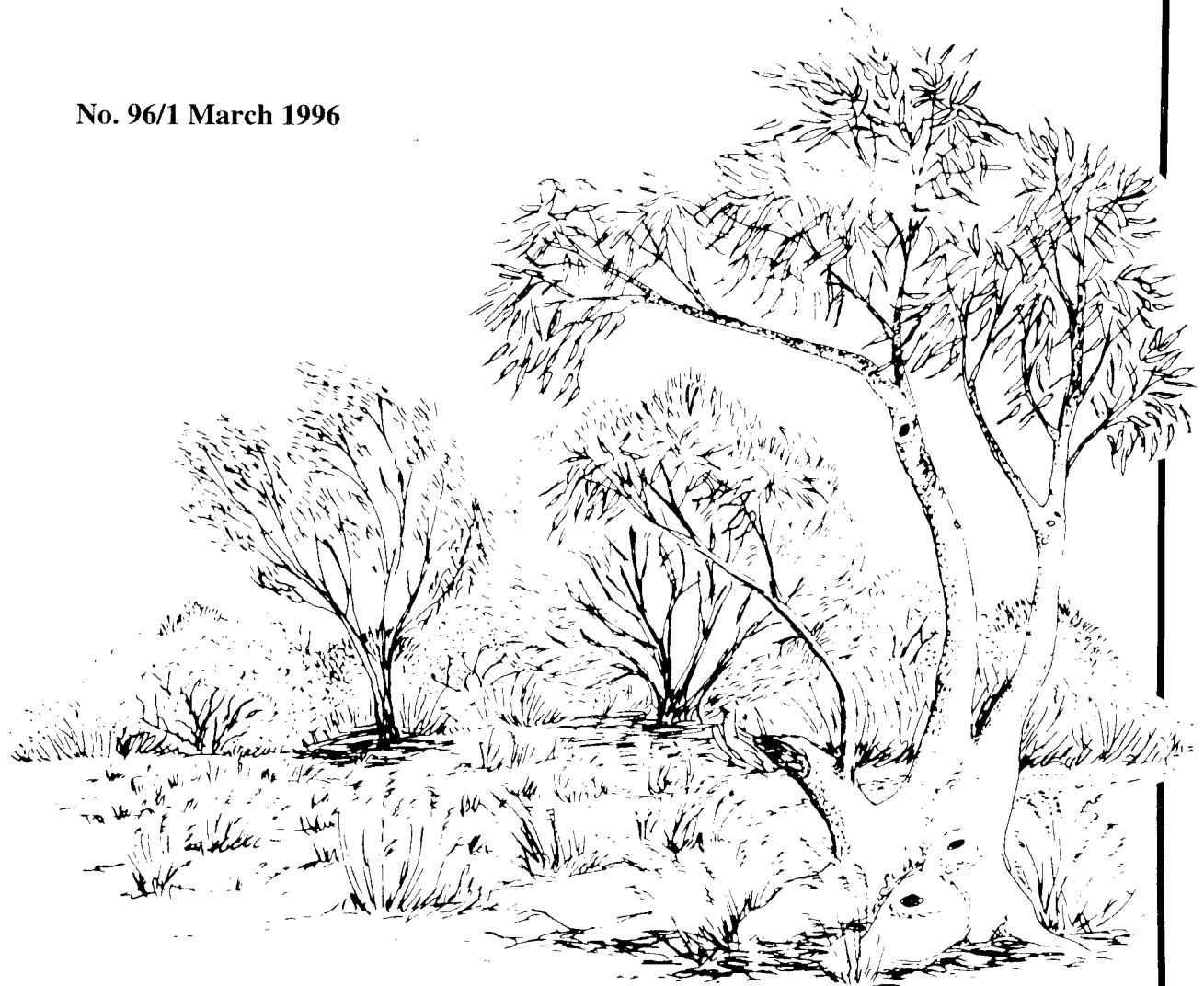


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EDITOR (RMN)

Gary Bastin
CSIRO, PO Box 2111, Alice Springs NT 0871
Phone (089) 500137 Fax (089) 529587
Email: Gary.Bastin@dwe.csiro.au

EDITOR (Rangeland Journal)

Dr Allan Wilson
"Cal Col"
Deniliquin, NSW 2710
Phone and Fax (058) 823338

PRESIDENT

Ron Hacker
NSW Agriculture
PO Box 865
Dubbo NSW 2830
Phone (068) 811270 Fax (068) 811295
Email: Ron.Hacker@agric.nsw.gov.au

VICE PRESIDENT

Guy Fitzhardinge
PO Box 35
Mandurama NSW 2792
Phone (063) 675175 Fax (063) 675284

IMMEDIATE PAST PRESIDENT

Alec Holm
Dept. of Agriculture, Western Australia
Baron-Hay Court
South Perth WA 6151
Phone (09) 3683705 Fax (09) 3683751
Email: aholm@agric.wa.gov.au

SECRETARY (and Business Address)

Bill Tatnell
Dept. of Land and Water Conservation
PO Box 1840
Dubbo NSW 2830
Phone (068) 833043 Fax (068) 833099

TREASURER

Nick Milham
NSW Agriculture
PO Box 240
Parkes NSW 2870
Phone (068) 625233 Fax (068) 625237

SUBSCRIPTION SECRETARY

Rob Richards
Dept. of Land and Water Conservation
PO Box 235
Condoblin NSW 2877
Phone (068) 952033 Fax (068) 953406

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FROM THE EDITOR

Gary Bastin, CSIRO, PO Box 2111, Alice Springs NT 0871

Welcome to the first newsletter for 1996. As I write this, the seasonal outlook appears to have improved in northern Australia with reports of recent good rains across the Kimberley, Barkly Tablelands and north western Queensland. Here in the Centre, the weather remains dry. Apart from seasonal conditions, it looks like being a tough financial year for most people on the land with the recent big decline in beef prices and continuing depressed state of the wool market. Unfortunately, there is little of direct and immediate benefit that I, as newsletter editor, can offer pastoralists facing financial hardship through low commodity prices. However I hope that you will continue to stick with the Society because, in the longer term, it is your experiences and lessons in resourcefulness that will help in ensuring that the research and extension activities of government are relevant to the rangelands.

This issue has the usual good complement of interesting articles, letters to the editor, Society business and reports, and small pieces of more general information from around the rangelands. As well, there are brief reports on recent activities from each of the regional or state branches. Thank you to all contributors.

Two of the articles in this newsletter feature wildlife management issues. Harald Ehman and Rodger Tynan enthusiastically describe a program in South Australia to develop a wildlife management manual so that graziers (and other users of the rangelands) can better recognise individual species and their habitat requirements. It is hoped that more readily available information and an improved understanding of species' habitat requirements will allow land managers to manage their country in a way which assists in conserving these species.

Allan Wilson, in a somewhat despondent tone, questions the effectiveness of the current kangaroo management program. Allan is the Society's representative on the Commonwealth Government's Scientific Advisory Committee on Kangaroos. He argues that the way in which the present system is implemented does not adequately fulfil its objectives and that a better way of managing the kangaroo population must be found. Allan urges that our Society develop a policy on kangaroos (and total grazing pressure) for presentation to the Federal Government. A Kangaroo Policy Group was established after the 1992 Cobar Conference but I am not sure what the group's findings and recommendations to the Society were. Council has re-activated the Society's Policy Group and the issue of kangaroo management is something that the group might consider.

I am sure that you will find something of interest in this newsletter. Please keep your contributions, and any responses to articles in this issue, coming in. My deadline for the next issue is the end of May.

ECONOMIC PERFORMANCE OF PASTORAL BUSINESSES IN THE WESTERN DIVISION OF NSW

Ron Hacker, NSW Agriculture, PO Box 865, Dubbo NSW 2830

The economic performance of pastoral businesses in the Western Division of New South Wales was monitored for up to four years as part of the Western Uplands Landsafe Management Project. This project was established in 1990, with funding from the Murray-Darling Basin Commission's Natural Resources Management Strategy. Overall the project involved a wide range of activities related to sustainable land use in semi-arid rangelands. However the major effort involved financial monitoring and subsequent analysis of economic data in conjunction with physical, climatic and animal production data compiled for each property.

Sixteen cooperating properties were originally involved in the project, arranged in four groups of four properties in the Cobar, Emmdale, Brewarrina and Wanaaring districts. Using the FARMcheque package, project staff recorded production and financial data for three financial years for the Emmdale and Cobar groups, and four financial years for the others. Physical data for each property were determined from property plans prepared by the Soil Conservation Service. District staff of NSW Agriculture established and maintained vegetation monitoring systems on each property, and recorded animal condition data on an ad hoc basis. Two properties left the project for various reasons so that data for 14 properties were finally available for analysis.

Gross margin per hectare was taken as the primary index of economic performance. Rank correlation analysis was used to relate this index to a wide range of physical, climatic, production and economic variables. Multiple regression analysis was also used to identify the relative importance of some factors. Comparison of the management characteristics of individuals with high and low gross margins also contributed to the conclusions outlined below.

For much of the project seasonal conditions were poor and wool prices were severely depressed, particularly in the first two years. This combination of circumstances resulted in some concern amongst the cooperators that the results produced would not be "typical". However all cooperators were subject to more or less similar conditions and the results obtained by comparative and statistical analyses are thought to have general application.

Three major conclusions could be drawn from the overall analysis:

1. *Pastoralists should aim to maximise gross margin per head.* Although gross margin per hectare is primarily determined by the carrying capacity of the land, individual pastoralists have greater opportunity to increase gross margin per hectare by increasing gross margin per head than by attempting to carry more animals (provided the land is not substantially understocked).

2. *High gross margins per head were favoured by early response to drought, combined with "conservative" or "moderate trader" stocking policies.*

Neither early destocking nor conservative-moderate grazing alone necessarily resulted in high gross margins per head. The combination of heavy stocking and late response to drought was particularly damaging economically, and may be assumed to have adverse ecological consequences as well.

3. *Attention to product quality and marketing, as well as biological productivity, is essential for maximum economic returns.*

The project highlighted the extent to which short-term market fluctuations can outweigh biological productivity in determining economic performance. While standards of on-property productivity must be maintained, or improved where appropriate, pastoralists need to carefully consider product quality, particularly wool fibre diameter, and the options available for reducing market risk.

(The financial data on which this project is based were collected by Roger Maxey and Charlotte Finch. Other aspects of the overall project were undertaken by Ruth Barclay, Danny Norris, Terry Brill, Geoff Woods, Greg Curran and Mark Ritchie of NSW Agriculture. Copies of the final report may be obtained from Ron Hacker).

RANGELAND AWARENESS SURVEY

Ron Hacker, ARS President, c/- NSW Agriculture, PO Box 865, Dubbo NSW 2830

**How many Australians have spent time in the rangelands?
What do we value about them?
What are the key issues for management?**

In 1995 the Australian Rangeland Society commissioned the Roy Morgan Research Centre Pty Ltd to provide answers to these questions by a national survey of community attitudes to rangelands. The survey report, based on 1100 face-to-face interviews, comprises 31 tables in which the responses to three primary questions are tabulated on the basis of sex, age, occupation, and place of residence. Responses to the individual questions are also cross tabulated. The report will be of value to all those with an interest in the use and management of Australia's arid and semi-arid lands, including all sectors of the rangeland community, government agencies, tourist operators, miners and other entrepreneurs, students and researchers.

Copies of the *Rangeland Awareness Survey* can be obtained from the Treasurer, Australian Rangeland Society, PO Box 240, Parkes NSW, 2870 (Tel: 068-62 5233; Fax: 068-62 5237) at a price of \$25 for ARS members and \$150 for non-members. Membership of the Australian Rangeland Society costs \$50 per annum for individuals.

MONITORING OF WOODY WEED COVER IN WESTERN NSW

David Gardiner, NSW Agriculture, Locked Bag 21, Orange NSW 2800

Introduction

Woody weeds are native shrubs which increase in density in the rangelands and compete with grasses, thereby reducing the availability of forage in good pasture land. High densities of these shrubs can also limit the access of stock to some areas. Woody weeds lower grazing capacity and consequently reduce the productivity of rangelands.

Woody species which are considered a pest in western New South Wales include turpentine (*Eremophila sturtii*), narrow-leaf hop bush (*Dodonea attenuata*), broad-leaf hop bush (*Dodonea viscosa* var. *angustifolia*), punty bush (*Senna artemisioides* var. *nemophila*), budda (*Eremophila mitchellii*), mulga (*Acacia aneura*) and silver cassia (*Senna artemisioides*). All of these species occur in the bumble box-white cypress pine (*Eucalyptus populnea*-*Callitris glaucophylla*) association. The belah-rosewood (*Casuarina cristata*-*Alectryon oleifolius*) association also occurs extensively in western New South Wales and is another community which is vulnerable to shrub increase (Weir *et al.* 1992).

With more than 20 million hectares of the Western Division already affected by woody weeds (Hassall *et al.* 1982), the problem needs to be monitored to determine the future impact of shrub increase on pastoral lands. The large area involved means that efficient methods must be used. We are currently mapping the occurrence, density and change in cover of woody species using satellite data.

Method

Full-scene digital Landsat Multispectral Scanner (MSS) images are selected for two dates between 10 and 20 years apart. The images are usually for dry periods because these give better discrimination amongst land cover types. Each image is geocoded to the Australian Map Grid and resampled to 100m pixels.

Spectral values are determined for "dense woody cover", "green vegetation" and "bare soil" land cover types and then each image is classified using a pixel unmixing algorithm called the Vector Classifier (McCloy 1977) on the basis of these spectral classes. The Vector Classifier produces an estimate of woody species cover based on the proportional contribution of the three land cover types to total spectral response.

Nodes representing spectrally pure values for each cover type are determined by examining the displayed false-colour composite image and scattergram plots of various MSS bands. Values are fixed for the "green vegetation" and "woody cover" nodes, but the "bare soil" node is varied so as to achieve

the theoretical 100% cover level for subsequent classification. Actual positioning of the "bare" node is based on soil reflectance and is representative of the soil colour for the majority of sites - and therefore the majority of the image. "Hard red soils" are typical of most areas surveyed, so an initial node based upon this soil type is chosen. Each MSS image is then classified with the Vector Classifier and an image representing the density of woody cover is derived. The image is rescaled to new values ranging from zero to the maximum percentage woody cover determined from field data. (Further details about methodology are provided in Cofinas *et al.* [1992]).

Ground truthing involves the estimation of woody cover from enlargements of aerial photographs taken from a gyrocopter. These photographs provide both a contemporary and historical picture. Up to 40 sites throughout each Landsat image, each measuring 300m x 300m and covering a variety of land systems and woody-cover densities, are selected. Three or four aerial photographs are taken at each site using a 35mm camera. The site's position is recorded with a ground-based GPS and is later used to georeference the aerial photographs with the classified satellite data. Sites are located along tracks to allow accessibility by car, which increases the efficiency of sampling large areas relatively quickly. Woody cover is estimated from enlargements of the aerial photographs using a dot grid overlay. These data are compared with the estimates of woody cover obtained from classifying the MSS image. Where differences occur, the percentage error is used to adjust the value of the "bare soil" node and the image is again classified. This procedure is repeated until the classified cover data for most of the sites are within 10% of the photo estimates.

Approximately 20 of the 40 air photo sites are used for modelling the Vector Classifier. The remainder are used to develop a linear regression between woody cover obtained from classifying the MSS data and that measured through air photo interpretation. When the accuracy of the final classification has been confirmed, this regression is used to calculate the actual woody cover for the entire classified MSS image.

The classified image of estimated woody cover is imported into a geographic information system (GIS) where it is combined with map layers showing the location of property boundaries and roads. Several map types are produced:

- Woody cover for individual dates.
- Change in woody cover through time - where the cover for an earlier time is subtracted from the cover present in a contemporary image.
- Emergent woody cover - which shows the percentage cover from the contemporary data for pixels which had no cover in the historical image.

The cover data are reclassified into 20% classes for presentation. Standard map products at 1:500,000 and 1:250,000 scales show road and property boundary information, and property maps are produced at 1:100,000 and 1:50,000 scales. All maps can be supplied with statistics showing the area in each cover class. Digital data and hardcopy maps are distributed in a GIS format to regional offices, and field days are organised with landholders to raise awareness of the project and extend information on woody weed management strategies.

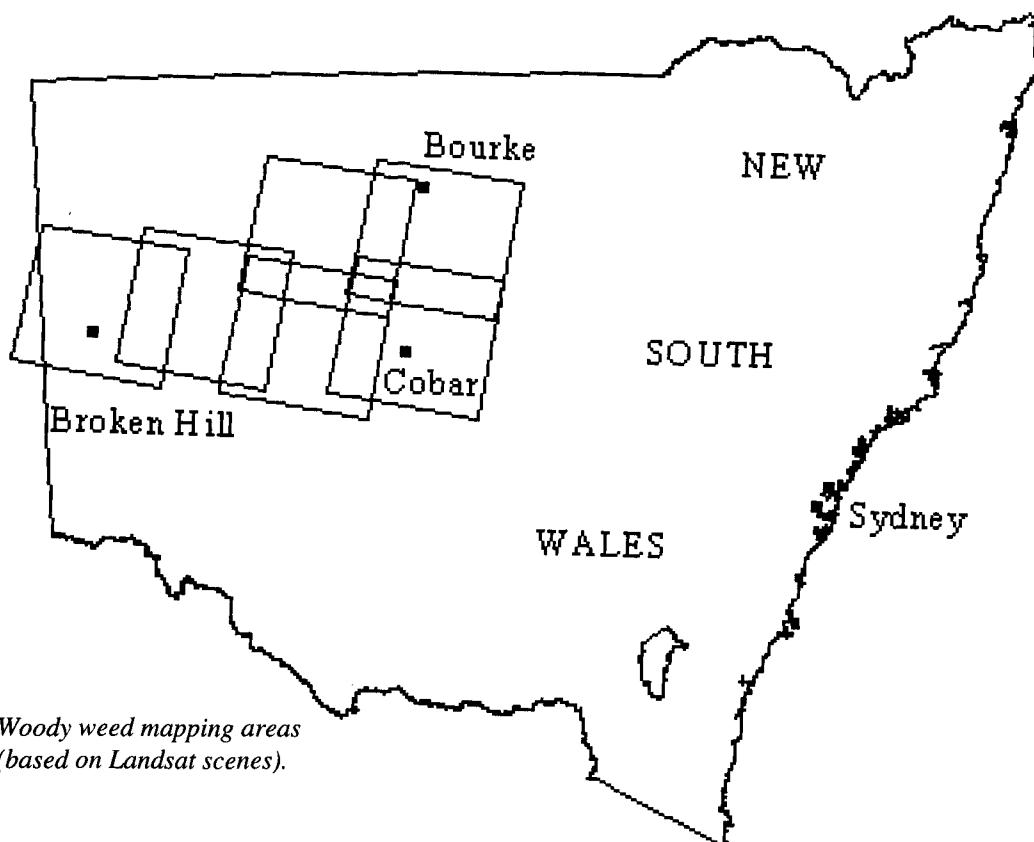


Figure 1. Woody weed mapping areas (based on Landsat scenes).

Woody species cover has thus far been mapped for the Bourke, Cobar, Louth and Barnato areas, and will be mapped for the Wilcannia/White Cliffs and Broken Hill areas of western NSW (Fig. 1).

Results

The accuracy of classification is variable within each image, but the majority of the sites are within the 10% tolerance limit. However there are some sites that are adjacent to accurate sites which have large errors. These cannot be corrected with stratification of the image as they occur within the same land system type as the accurate sites. The Barnato 1973 image coincided with a period of high rainfall so green vegetation flushes would have affected the accuracy of classification. In the Bourke-Cobar area, a significant increase in woody cover (>30% increase over ten years) has been observed and this is largely associated with an increase in the cover of mulga. Moderate increases in woody cover (of 11 to 30%) have occurred further west around Louth and Barnato, while decreases are noted west and south of Barnato. The decreases can be attributed largely to wildfires rather than to any prescribed clearing.

At a recent field day and extension workshop, a number of landholders in the Barnato area responded positively to the woody cover maps. Consequently, individual property maps showing woody cover at each date and change in woody cover were produced and distributed to landholders for planning purposes. Maps are also distributed in response to occasional enquiries.

Discussion

The availability of historical aerial photography was a major constraint on the selection of imagery. The images had to be close to the date of photography and in a reasonably dry period to achieve optimal classification results.

The behaviour of the Vector Classifier is not consistent for all sites. As discussed previously, the value assigned to the "bare" node prior to classification must be varied to achieve optimal accuracy for all sites used in the modelling procedure. For most sites the error values change consistently with a change in the "bare" node value. For a few sites, however, the change in error value may be exaggerated relative to the other sites and in the opposite direction. These spurious sites cannot be easily corrected, so the aim of minimising errors for the majority of the sites becomes the main objective of classification. Occasionally, parts of floodplains and water bodies are misclassified as woody cover. This occurs because the spectral values for woody cover are very close to the spectral values for water. The misclassified areas are masked out from the woody cover data to overcome this problem. Over-classification is considered a better result than under-classification, in which no woody cover is shown where woody cover does exist.

Using a gyrocopter to obtain aerial photography has improved the accuracy and efficiency of fieldwork compared with the

previously used ground-based "step-pointing" method reported by Cofinas *et al.* (1992). It now takes only a few minutes to photograph each site for later measurement, compared with the previously required two hours of ground traversing to measure woody cover. Consequently, more sites can be sampled over a larger area and this results in greater overall accuracy for each area.

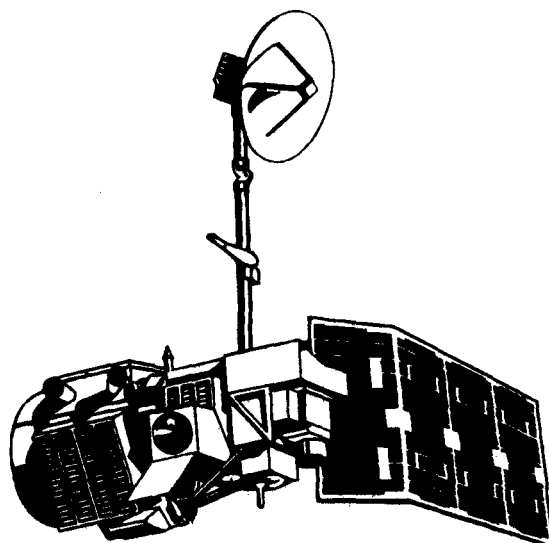
Improvements in GIS analysis and map production have been made during the project such that image processing and maps for one area can now be produced within six months.

The strong response from landholders and government agencies is an indication of the planning and management potential of the woody cover data. Application of this remote-sensing technique for mapping woody species cover in land types elsewhere is possible provided the Vector Classifier is used correctly and ground truthing is thorough.

Further enquiries regarding the Woody Weed Monitoring Project should be directed to David Gardiner or Graeme Tupper, NSW Agriculture on (063) 913 143 or Locked Bag 21, Orange NSW 2800 or Email tupperg@agric.nsw.gov.au.

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KNEE-DEEP IN NIGHT PARROTS?

Initiatives for Off-Park Wildlife Management in South Australian Rangelands.

Harald Ehmann and Rodger Tynan, Pastoral Management Branch, SA Dept of Environment & Natural Resources, GPO Box 1047, Adelaide SA 5001

Introduction

The decline and extinction of native animals in the arid zone of Australia since European settlement is extensive (Australian National Strategy for the Conservation of Australian Species and Communities Threatened with Extinction 1992). These changes have been well demonstrated for mammals, birds and fish because Aboriginal inhabitants and Europeans have an abiding interest in these animals, so we have at least some historic information on their distribution and abundance. However for reptiles, frogs or insects there is little information. Some native mammals have increased in abundance due to favouring factors brought in by European settlement (e.g. large kangaroos using watering points).

In higher rainfall agricultural areas native animal decline and extinction have been partly attributed to clearing of native vegetation and alteration of wetlands, rivers, lakes and streams (draining, waterflow changes and water removal) (Tay 1992). Concentrated grazing by stock, rabbits, large kangaroos and feral animals is known to alter the structure, cover, and composition of native vegetation. However the scientific study of the relative impacts of each of these is recent (e.g. studies of total grazing pressure). The extinction of many species of native mammals from huge areas of the arid zone which have never been grazed by stock indicates that stock grazing alone cannot be the major cause (Kennedy 1992). The introduction of competitors such as rabbits, predators such as foxes and cats, and possibly some diseases or parasites may have been more significant. Changes in the nature and frequency of fire since traditional Aboriginal use also appear to have had a detrimental effect in some areas (Burbidge & McKenzie 1989).

Maintaining biological diversity is a key national objective for sustainable development and land care practice (National Strategy for the Conservation of Australia's Biological Diversity 1996). It is also an objective of the South Australian Pastoral Land Management and Conservation Act 1989.

A grant to the Pastoral Management Branch of the South Australian Department of Environment and Natural Resources (DENR) from Save the Bush Funding (a Landcare initiative) has allowed considerable work to be carried out in furthering their common landcare aims. This article describes an approach in South Australia where the grant allows a user-friendly Wildlife Habitat Management Manual to be produced and provided to landholders in the Kingoonya and Gawler Ranges Soil Conservation Districts (SCDs).

Background

The conservation of native vertebrates in South Australia has to date relied on three broad strategies.

1. *Protective legislation (including bag limits) for most vertebrates (mammals, birds, reptiles and fish).*

While protective legislation (in its present form) is effective in restricting the hunting, taking or collecting of vertebrates, it falls short of being an effective conservation strategy.

2. *The setting aside of reserve areas (e.g. national parks, regional reserves) where vertebrate populations are protected and conserved.*

The reserve system in South Australia involves about 20% of the state (most of it in the arid zone). However these reserves do not include many of the key habitats needed by many vertebrates to ensure their long term survival.

3. *Significant private conservation practices by some landowners/managers - e.g. heritage agreements to conserve remnant vegetation, establishment of wetland complexes on private land, exclusion of stock from bores/wetlands and mound springs, and electing to leave areas undeveloped.*

Privately-initiated conservation practices in the arid pastoral lands are the core of a potentially large and effective conservation strategy for non-reserve areas in the state. Indeed it is now widely held that long-term survival of many vertebrates will only be possible if active non-reserve management occurs (National Biodiversity Strategy 1996). This must be based on adequate information about each species' life requirements and the dynamics of its populations. However, most of the available information is in scientific reports and is not easily accessible to land managers.

Outcomes

The important species, the critical habitats, and survey work

Existing data on vertebrates in the arid pastoral lands and especially the two SCDs were collated from the records of the South Australian Museum, DENR Biological Surveys Database, literature, as well as from personal contact with landholders, naturalists, field workers and ecologists. The vertebrate species (and their habitats) that are endangered, vulnerable, rare or of other significance to land managers from within the two SCD's were singled out for specific coverage in the Wildlife Management Manual.

The *critical habitats* that were identified are:

1. Lower lying areas with enhanced water availability or retention: the so called "sweet areas" (e.g. intermittent water courses, water holes, ephemeral swamps or soaks). These are habitats which have been identified as critical to native mammals in providing drought refuges (Morton 1990).
2. Run-on areas around massive sheet and hill-like outcrops of impervious rock, namely widespread granite outcrops and the massive rocky hills of the Gawler Ranges. Such

- run-on fringing areas receive nutrients and additional water which have a potential for high biodiversity, and can better support native species of vertebrates during drought.
3. Rocky areas (in ranges especially) where there are local entrapments of water either in soil pockets or in rock holes. Such habitat is important for yellow-footed rock wallabies. Many (but not all) vertebrates dependent on this habitat type have persisted despite other habitat changes.
 4. Woodland vegetation with a complex understorey structure (the best example is mallee with a *Triodia* hummock grass or shrub dominated understorey). This habitat has abundant and complex resources - especially shelter sites and nesting sites (e.g. hollows) for reptiles, mammals (especially bats) and birds (e.g. pink cockatoo). Malleefowl are highly dependent on such complex vegetation.
 5. Partly stabilised high dune crests and slopes. This habitat type is particularly important for the Pernatty knob-tailed gecko which is restricted to this habitat type and which may possibly be under competitive pressure from a closely related gecko species that inhabits swales and sandplains.

These critical habitat types require sensitive management of all impacts to ensure that wildlife (especially vertebrate) biodiversity is retained and if possible restored (e.g. rehabilitation of mammals that are now locally extinct).

Biological survey work was carried out in the north-eastern sector of the Gawler Ranges Soil Conservation District and focused on Mahanewo, Wirraminna South and Yalymboo properties (where no fauna surveys had been conducted previously). Some opportunistic survey work was also carried out on Moonaree, Nonning, Oakden Hills, Pernatty, and Yardea properties. Field work in the Kingoonya Soil Conservation District yielded subfossil bones from a rock shelter including nine species of mammal - of which two are important range extensions of now extinct species.

The Wildlife Management Manual and Poster

The available information on the identification, management and conservation of 25 key species and their habitats has been collated and is presently being compiled into a manual. The manual's format is based on advice from landusers and has a practical layout.

As an adjunct to the manual, and also as "stand-alone" information, a colour poster (A1 size) is being produced. This will be available as a resource document to schools, pastoralists, naturalists and others interested in landcare in the pastoral districts of South Australia. It shows some of the key species and habitats and describes factors that may be important for management.

The heart of the Manual is the section relating to individual species. Each account includes information on:

- how to detect and identify the species;
- status at the national, state and district level;
- interesting behaviours;
- food and water needs;
- reproduction;
- habitat;

- threats to survival;
- management recommendations; and
- a list of references.

The Manual includes information on other issues and problems in wildlife management such as rabbits, foxes, fire, poaching, rehabilitation, where to get wildlife management and funding advice, and ecotourism.

Co-operative Management

We have attended meetings of the two Soil Boards to familiarise members with the project and its objectives. Soil Board members and pastoralists have also provided valuable information and advice on habitats and habitat characteristics that are considered to be important to key vertebrates. In addition pastoralists have had input into the design and format of the Wildlife Management Manual. Follow-up meetings to publicise the release of the manual and to demonstrate its use are scheduled.

Liaison has occurred (and is continuing) with formal presentations and discussions (7 to date, at least 4 more planned) with landusers, pastoralists and conservationists. While limited by the logistical problems of visiting each property, nonetheless contact and discussions have occurred with about 30 pastoralists. Information provided by them has been incorporated into the manual. All who have been contacted have a very keen and positive interest in the management of wildlife on their properties, including (significantly) their children.

The start of a wildlife management network?

It became apparent early in the project that the liaison process on best management practice for wildlife conservation would need to be ongoing. Much of the detailed management information is not yet available for some species. The issues of (1) feral animal control, (2) total grazing pressure issues, and (3) rehabilitation of wildlife species that are presently locally extinct or adversely affected, all require the development of a liaison network that includes pastoralists, managers, researchers, conservationists, naturalists and even professional shooters and trappers.

Accordingly the manual includes:

- information on contacting each of these elements within the network, and
- advice to landusers on how they can contribute to the important data gathering process which will enhance the management resource base.

Outlook

There is general agreement that the ongoing retention of biodiversity is an important measure of the health of an ecosystem. This in turn reflects sustainable use of the Australian rangelands, for whatever human activities are dependent on it. We can hardly be certain of future uses. At present these are pastoralism, Aboriginal use and ecotourism yet a mere 20

years ago the latter two hardly rated. All the more reason to retain and even rehabilitate biodiversity.

It is well known that pastoralists are adaptable and very resourceful people, and we have often seen the keen interest that they show for sustainable use of the pastoral lands in the full sense of the concept. These characteristics auger well for wildlife management and the bigger picture of maintaining biodiversity. Pastoralists in the Kingoonya and Gawler Ranges SCD's will soon be able to easily access wildlife management information and consider the needs of wildlife in their station management.

The interest shown so far may encourage:

- pastoralists reporting significant animal sightings and forwarding specimens for identification or further study,
- heritage agreements to ensure that areas of high-quality wildlife habitat are protected from adverse impacts,
- cooperative conservation projects - e.g. programs for the control of feral animals in sensitive areas and habitats,
- ecotourism as a significant income source for pastoral lessees.

Perhaps we will be knee-deep in night parrots before too long!

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KANGAROOS, SHEEP AND RANGELANDS

Allan Wilson, "Cal Col", Deniliquin NSW 2710

I have represented the Australian Rangeland Society on the Commonwealth Government's Scientific Advisory Committee on Kangaroos (SACK) since 1990. This committee had the task of advising the Minister for the Environment on the conservation and harvesting of kangaroos. The main business has been to give some form of "scientific" approval to the commercial culling quotas submitted by each State.

This committee has now been disbanded, with its obligations folded into a new committee called the "Scientific Advisory and Review Committee on Wildlife Use". The new committee has the broader mandate of considering issues concerning the commercialisation of native flora and fauna.

It is therefore an appropriate time to review the system of setting quotas for harvesting kangaroos and to more generally report to the Society on the workings of SACK. Kangaroos are an important issue in the rangelands because most of the 20-30 million large kangaroos in Australia (comprising a number of species) are found on the rangelands, and a large proportion of these on the "sheep" rangelands, where water supplies are plentiful and dingoes are absent or rare.

Existing Kangaroo Management Program

The various kangaroo management programs, which are State based but Commonwealth approved, have three broad aims. These are:

- (a) to maintain viable populations of each species over its existing range,
- (b) to manage the harvested species as a sustainable resource, and
- (c) to mitigate damage to vegetation and the pastoral industry caused by high populations of kangaroos.

In practice the quota has always been set to meet the first aim, with no regard for the other aims. The quota set is generally expressed in terms similar to "The commercial cull quota of 0.5 million represents 16% of the estimated population of 3.1 million, which will have no long-term detriment to the population". No consideration is ever given to meeting aims (b) or (c), although additional culling to mitigate against damage to the pastoral industry can be carried out by pastoralists, provided the animals do not enter the trade.

The conservation of kangaroo species is made even more secure by under-estimation of the population through the use of outdated correction factors and the conservative estimation of the possible sustained yield - defined as the level of culling that can be sustained over a long period without causing a decline in numbers. The correction factor is the multiplier used to allow for kangaroos not seen from the air along counting transects. New South Wales still uses the Caughley correction factors (1.8-2.5), when the actual correction factors

might range from 1.8 (for open country) to 4.2 (in wooded country) for reds and 4.8 (open country) to 16.7 (wooded country) for greys (Southwell 1989).

It is not surprising therefore to find that estimates of the number of kangaroos do not seem to be related to the level of culling, but rather rise and fall with rainfall (i.e. forage supply). For instance, the total NSW population of reds, western greys and eastern greys (estimated by Caughley correction factors) rose from 3.4 m in 1975 to 9.3 m in 1982, fell to 2.8 m in 1984 after the drought, rose again to 9.3 m in 1991 and fell to 6 m in 1994 after the next drought (data from NSW National Parks & Wildlife Service). Commercial culling must have some impact on kangaroo numbers but it is apparently less important than starvation.

My conclusion is that the commercial quota is set more by convention than by scientific data. There is little scientific relationship between the three aims and the actual quota. Two aims are ignored, the population of some species is underestimated by a wide margin and the sustained yield percentage used may be much lower than the true sustained yield, given the male bias in the harvest (shooters prefer to take males because they are larger). There are differences in methods between States and no reasoned argument as to why this should be so. The system was appropriate in 1975 when conservation was the only issue considered and current methods and information were not available but it is inappropriate now. My minority requests for a review of the system to bring it into the modern era have been quietly ignored by the Australian Nature Conservation Agency (ANCA) over the last three years.

Is There A Better Way?

Speaking more generally now than about SACK, I find the present situation may be satisfactory for the conservation of kangaroos, but is not satisfactory for the balanced conservation of other elements in the rangelands, including the land and pastoralists. I do not believe that a better commercial quota system will necessarily solve all the problems of high kangaroo numbers in the rangelands for reasons presented below. It is nevertheless part of the problem we have in obtaining control of total grazing pressure, particularly in the open semi-arid woodlands of eastern Australia, where the density of kangaroos is highest. It is generally thought by range scientists that the total grazing pressure by all animals in these regions is too high. We have a problem with feral goats and there are campaigns to harvest and reduce them. Rabbits occur widely in southern and central Australia and some relief may be gained with the new calicivirus. There is a problem with the overstocking of sheep on some stations and this is recognised and addressed by extension and Landcare programs. However, there is also a problem with kangaroos - which is not recognised.

Taking all animals together, the problem is large and cannot be addressed by a focus on any one species. The emphasis in this article is solely on kangaroos since they are the animals that are presently outside the debate. I have discovered that many wildlife biologists, who control the debate on kangaroo

harvesting, do not understand the need for the control of kangaroo populations (see, for example, the Proceedings of the 1995 QDPI/Centre for Conservation Biology Workshop on Total Grazing Pressure; in press). This is despite general knowledge that kangaroos and sheep eat the same vegetation and have the same ability to reduce forage to a low level. Further, they fail to take account of numerous studies which show that kangaroos prevent range rehabilitation on destocked paddocks and inhibit graziers in their desire to rest paddocks for rehabilitation. There is diet and habitat separation between the various herbivores in part, but there is sufficient overlap over time for there to be a large impact that reduces carrying capacity in dry years - which are the years that control the carrying capacity and the profitability of a station for all years. As a consequence of the perceptions of many wildlife biologists, there is little impetus for change in the kangaroo harvesting system. The problem is left squarely with graziers who get no return for carrying kangaroos at levels that are now far in excess (e.g. 30 per sq km) of that needed "for the conservation of species across their range" (e.g. 2 - 4 per sq km). Graziers must either suffer a lower income or revert to damage mitigation culling at their own expense, such as that detailed by Peter Clark at Longreach (Clark 1995). A kangaroo control system that reduces numbers in dry years also makes economic sense. For example, Barclay and Hoadley (1994) estimated an improved cash surplus of \$82,000 over a ten year period for an average station implementing a kangaroo control system that reduces kangaroos numbers in dry years only.

We need a better balance in the debate. This is a balance that includes the sustainability of our rangelands, the sustainability of pastoral enterprises (sheep, mixed or kangaroo) and the conservation of other fauna, as well as the conservation of large kangaroos. Kangaroos are present in almost equal numbers to sheep in the eastern rangelands, yet they are the only ones that are now left to die on the land during a drought. What is their impact on the vegetation? The data from Mt Mulya Station near Louth speak for themselves. In 1991 and 1992 sheep numbers were reduced to 3300 from the normal 10,000. However, a count of other herbivores by helicopter found 9000 red and grey kangaroos present. On Bukulla Station the count was 4400 sheep and 8030 kangaroos. Feral goats were also a problem on these stations, but there is agreement that these should be reduced. Any degradation that may have occurred during the drought was therefore unlikely to be the result of sheep grazing. Was it due to kangaroos?

The Grigg hypothesis, that both the rangelands and pastoralists would be better off if sheep grazing was replaced by kangaroo harvesting, seems to have been adopted eagerly by many wildlife biologists. It apparently fits preconceived notions that all sheep are evil and kangaroos can do no wrong. Unfortunately, whilst there has been some limited economic benefit for some graziers from harvesting kangaroos, its viability as an industry for landholders in its own right is still far away. It is important that we work towards making kangaroo harvesting an alternative industry for pastoralists. However, it must be realised that if we are to do so, there will be a need for much improved property rights for graziers over harvesting, a much improved industry that can add greater

value to kangaroo products, and further, the need for the landholder to control the population of kangaroos.

This latter point is vital. Any system of grazing, indeed any system of animal husbandry, must control the total population of grazing animals and the composition of that population. The conservation of the pasture depends on controlled grazing, whether it be by sheep, goats or kangaroos. It is not "sheep" *per se* that overgraze, but too many sheep at the wrong time. The same is true for all herbivores world wide. Kangaroos, in uncontrolled numbers, prevent rangeland rehabilitation by preventing the resting of pastures for seeding or burning and cause loss of grasses during droughts. (The case for this is too long to develop here.)

Furthermore, the efficiency of the system of converting grass to saleable product depends on providing sufficient grass to keep the animals growing, not just enough to keep them alive. It also depends on manipulating sex and age structures. Sheep stations do not keep all the sheep in the proportion in which they were born, shooting a few rams each year to fill the quota, and retaining the rest through until they die. Grazing enterprises are not wildlife systems. Everyone must recognise, wildlife biologists included, that full kangaroo "farming" will never come about until graziers are given the ability to control the animals. This means that government must share some of its present all-embracing rights over kangaroos with landholders, who are the people who have to develop and manage the enterprise and the land.

More Immediate Requirements

Kangaroo "farming" is still a way off. In the interim we will have sheep grazing and kangaroo harvesting-existing side by side. In the immediate future we need a commercial cull quota that:

- meets all three aims of the management program (e.g. conservation dominant at low numbers, damage mitigation dominant at high numbers),
- brings the majority of the cull into the commercial arena,
- is based on an objective mathematical model of population, current forage, expected rainfall (including drought index), population composition and harvest (or more simply is based on an adaptive management strategy), and
- is allocated to pastoralists or shooters in a way that supports the aims and is equitable to all concerned.

The quota has not often been met by the actual harvest over the last 20 years, but the actual harvest is now approaching the quota. Where the quota is being reached, it begins to have value in itself and must be allocated in a manner that naturally serves the various aims. A first come - first served basis is unlikely to do this.

At the Society level there is a need for the development of a policy on kangaroos and total grazing pressure and its presentation to the Federal Government. The views of the rangeland community are not being presented at the highest level, with the consequence that the policy agenda has been captured by others.

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NOTICE OF ANNUAL GENERAL MEETING

Ron Hacker, ARS President, c/- NSW Agriculture, PO Box 865, Dubbo NSW 2830

The 1996 Annual General Meeting of the Australian Rangeland Society will be held at the offices of NSW Agriculture, Carrington Avenue, Dubbo at 5.30 PM on Monday, 27 May, 1996.

The business will include:

- report of the Council for the year 1995-96,
- 1995 financial report, and
- general business.

All members are invited to attend the AGM. Any member wishing to place an item of general business on the agenda should notify the item to the Secretary by 13 May, 1995. Light refreshments will be served after the meeting. If you will be attending the AGM please advise the Secretary (Bill Tatnell) at the Department of Land and Water Conservation, Dubbo; ph. (068)-83 3043; fax (068)-83 3099.

LETTER TO THE EDITOR

Thoughts From '58

Stan Marriott, 14 Curlew Crescent, Beenleigh QLD 4207

In view of the encouraging and important items in the November Newsletter, I wondered if readers would be interested in extracts from a summary and musings I gave at the then Queensland Department of Agriculture and Stock's first Agrostology School. This school was held at Brian Pastures, Gayndah, in 1958. I am sure pasture workers in other States at that time already had more or less formal analyses of pasture problems and procedures relevant to the various States. This was the first one in Queensland, although some old-timers had had visions for the future.

Newcomers to the field of Pasture Research and Extension are almost one-and-a-half generations on, and may be dealing with a completely new set of tools and techniques, of which some are a bit mind-boggling to a 87+ year-old.

Sixty three years ago I was fascinated by A.W. Sampson's *Range and Pasture Management* (published in 1923) and his concept of standing fodder reserves and seed production resulting from "deferred grazing" practices. At the same time I learnt first hand that some Channel country properties were also maintaining standing fodder reserves in the 1920s, prior to the drought of that decade.

In the 1950s I was privileged to see the results of H. Suijdendorp's similar-type sheep grazing trial on Abydos Station; and at a field day there, heard middle-aged graziers saying it was the first time they had seen some of the "softer" grasses in that spinifex country. These species were appearing in the "deferred" treatments. It was therefore of great interest to read the article by Greg Brennan (Agriculture WA) describing "strategic management practices such as wet season spelling of some pastures" as one of the practices helping in the rapid improvement in range condition on most leases in the Kimberley.

That certainly reminds me of Prof. A.W. Sampson and "Deferred Rotational Grazing" of 1923 and of the Abydos work in the mid 1950s. Perhaps other rangeland workers have been using the same techniques for a long time.

Incidentally, it was a privilege to meet Prof. Sampson at Berkely University in California in 1960 on my way back from the International Grasslands Congress in England.

Now to extracts from my closing remarks at the 1958 Agrostology School which were pertinent then - and I think remain so today:

- The concept of the soil-plant-animal complex has come to stay and, inasmuch as the coordination of research is intensified, so will the rate of achievement be accelerated.
A threefold cord is not easily broken.
- We all, whatever our specialist titles and interests may be, should adopt the ecological approach to our pasture problems. Such an approach will ensure that we consider in our problems such factors as the environmental influences of

climate, physiography and soils, together with an appreciation of the important plant characters of morphology, physiology and reproduction, plus the all-important effect of grazing animals and their management by man.

This ecological approach on a regional basis will, I think, supply the safeguards needed when assessing the problems before us.

With this in mind we will become aware, with almost every problem, that the efficiency of research projects will usually be increased by co-opting other specialist advice, including that of the Biometrician.

- We have been privileged to see on Brian Pastures the early stages of relatively detailed studies ... aimed at giving us concrete information on which to base pasture utilisation. It is, properly, work for a Research Station. Can it be extended to other stations? It should be, but if it is, will care be taken to ensure that overlapping is avoided and that the operatives are not merely copying techniques but understand the problems before them? With our shortage of manpower and limited material resources, overlapping and unnecessary duplication would be criminal. If necessary let us use one species in common, where conditions are suitable, so that a basis for comparison between districts will exist. ... It is this type of (repeated) work which ultimately will lead to an understanding of what can be expected from our pastures by way of grazing ... without detriment to the plants.
- ... in Queensland's pastures we have valuable natural assets which have been exploited rather than explored. It is apparent that while we search for new species from abroad, we must study and compare with the exotics our own indigenous species under comparable conditions.
- Within practical limits we obviously need to learn much more about the soil micro-flora and the relative efficiencies of non-symbiotic nitrogen, rhizobial nitrogen and "combined" nitrogen. What do we know of the basic effects on the micro-environment, in terms of micro-flora and fauna, soil moisture and organic matter which result from mulching down grass rather than burning it?
- I have been reminded again of a statement in my opening talk - "At least for many generations we will have to live with our native species in the great bulk of our pastoral areas". To this can be added the slowly growing areas of sown pastures which together with our native grasses form Queensland's most important crop. The efficient use ... of these sources of animal food, in order to provide a higher plane of animal nutrition for a longer period than is now possible, is a major goal of the Agrostologist.
- To sum up, the end point of the Agrostologist's aim is the preservation of our basic natural asset - the soil, the most efficient possible utilisation of the soil's products (grass, forbs, trees and crops) and the most efficient transformation of those products into saleable commodities which form such a large proportion of our national income.

(Ed. Stan provided the complete transcript of his closing remarks at the Agrostology School. I have considerably condensed his talk to reproduce comments relevant to the science of range management. I trust that in doing so, I have not done Stan an injustice.)

LETTER TO THE EDITOR

Native Seed for Rehabilitation

Tom Farrell, Principal Environmental Scientist, Woodward-Clyde, Level 6, 486-494 Pacific Highway, St Leonards NSW 2065

With reference to Margaret Friedel's letter in the November Newsletter (RMN 95/3 p. 6), I offer the following.

The issue of provenance with native seed has been addressed at recent Minerals Council of Australia Environmental Workshops. Stephen van Leeuwen, from CALM in WA ("Provenance seed for the rehabilitation of mined land", *Proceedings of the 19th Annual Environmental Workshop*, Volume II, Karratha WA, October 1994), supported the use of provenance seed in enhancing the success of mine rehabilitation. He provided a discussion of the pros and cons of using provenance seed, and concluded that the benefits far outweighed any disadvantages. Broad guidelines for determining the area of a provenance were proposed, with the general proposal that physiographic units be divided into smaller areas based on the superimposition of 1:250,000 cadastral map units. In order of significance, the area of a provenance was recommended as:

- The biogeographical region;
- The physiographic (landscape, land system) unit;
- The appropriate 1:250,000 map; and
- The drainage catchment in which the rehabilitation site occurs.

Kerryn O'Connell from Curtin University ("Ecology of *Ptilotus* species in the Upper Fortescue Valley, Pilbara, Western Australia", *Proceedings of the 20th Annual Environmental Workshop*, Darwin NT, October 1995) discussed the factors controlling the distribution of *Ptilotus* species in the Fortescue, and the implications for minesite rehabilitation. Sonia Finucane, from Dames & Moore in WA, applied Stephen van Leeuwen's approach to planning for rehabilitation at the Marandoo Project in the Hamersley Range ("Applying the Concept of Provenance to Seed Collection", *Proceedings of the 20th Annual Environmental Workshop*, Darwin NT, October 1995), and developed further guidelines for provenance delineation and seed collection for the project.

Research on *Acacia melanoxylon* for my M.Sc. degree showed that there was a gradation in ecotypes of *A. melanoxylon* from arid grasslands to cool temperate rain forest. Seedlings grown using seed from a range of environments showed genetic variability in factors which would provide some competitive advantage in the "natural" environment. However, the seedlings also demonstrated some ability to adapt to the growth environment by developing characteristics more typical of the local ecotype.

What all this work suggests to me is that the use of provenance seed may result in a competitive advantage in establishing the species in a disturbed environment and that this factual evidence currently outweighs the unproven arguments about the need to preserve genetic diversity.

APPLICATION ABSTRACTS

THE RANGELAND JOURNAL

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The Effects of Grazing Exclusion and Blade-Ploughing on Semi-Arid Woodland Vegetation in North-Western New South Wales over 30 Months

A.D. Robson, Department of Conservation & Land Management, PO Box 342, Bourke NSW 2840 (present address: National Parks and Wildlife Service, PO. Box 1007, Dubbo, NSW 2830 and Graduate School of Environment, Macquarie University, NSW 2109)

Inedible native shrubs are considered to be a primary cause of lost pastoral productivity in the semi-arid woodlands of north-western New South Wales. Most rehabilitation programs have focussed on reducing shrub density. In recent years blade-ploughs have been tested for this purpose. Results have been variable and most programs have brought neither lasting shrub control nor improved production for pastoralism over the medium to long term. Failure to control grazing after initial treatment is suspected as one reason for the low success rate.

An experiment involving blade-ploughing and grazing exclusion was established in July 1990 in sandplains supporting semi-arid woodlands, near Bourke New South Wales (NSW). The treatment factors were crossed and each was imposed at two levels: present and absent. Shrub density, pasture composition and pasture biomass variables were selected and measured before, and over a 30 month period following treatment. Data were analysed using repeated measures ANOVA.

The densities of *Eremophila sturtii*, *E. desertii*, *E. gilesii* and *Dodonaea viscosa* ssp. *angustissima* as well as that of 'Total shrubs', all increased after ploughing, irrespective of the presence or absence of grazing. In all cases except that of *E. sturtii*, there was no significant difference between shrub density in ploughed and unploughed plots 30 months after treatment. While *E. sturtii* density increased significantly to begin with, it remained significantly lower in ploughed plots compared to unploughed plots at the end of the study period. This suggests that blade-ploughing offered only temporary control of these shrubs on this land type.

Pasture biomass was significantly greater in ploughed/ungrazed plots (1300 kg/ha) compared with other treatments at the end of the study. Ploughed/ungrazed plots were the only ones where fuel had accumulated to a level which offered any possibility of burning to control shrub regeneration. The same treatment also contained a significantly greater proportion of desirable pasture species than any other treatment at the end of the study period.

Effects of Temperature and Age on the Germination of Naked Caryopses of Indigenous Grasses of Western NSW

A.C. Grice, NSW Agriculture, P. O. Box 286, Cobar NSW 2835
(present address: CSIRO Division of Tropical Crops and Pastures, Davies Laboratory, Aitkenvale QLD 4184)
Alison Bowman, NSW Agriculture, Agricultural Research Station, Grafton NSW 2460 (present address: NSW Agriculture, Agricultural Research Centre, Trangie NSW 2823)
Ian Toole, NSW Agriculture, Agricultural Research Centre, Trangie NSW 2823

A laboratory experiment examined the effects of age and temperature on germination of seeds (naked caryopses) of nine native, perennial grass species found in the Cobar area of western New South Wales. Results suggest that seeds of some species, for example curly Mitchell grass and whitetop grass, can survive well in laboratory storage for up to at least two years. While species differ, optimum temperatures for germination of most species are between 20°C and 30°C. Seeds of some species are rather short-lived when stored under laboratory conditions but it is not clear how survival of naked seed in the laboratory compares with that of natural soil seed banks. Species such as curly Mitchell grass and whitetop, with good survival of stored seed, rapid germination and high germination percentages, have potential for development as sown pasture species.

The Effects of Grazing Activity on the Hydrology of the Bogong High Plains, Australia

R.E. Lawrence, Department of Geography, University of Adelaide, SA

Over recent decades, there has been a growing body of evidence suggesting that the century-old practice of grazing stock on the Bogong High Plains during the summer months every year has adversely affected the subalpine and alpine environment. Several studies have found that grazing activities have had an adverse impact on vegetation of the subalpine environment, and this has led many conservation groups to push for the total exclusion of cattle from all subalpine and alpine pastures in Australia. To date, the arguments have centred around the trends evident in the exclusion plots since the 1940s. This paper focuses on a different environmental parameter - the hydrology of several small subalpine catchments on the Bogong High Plains are examined with a view to determine the impacts of grazing activities on runoff. Long term declining trends in both cattle grazing numbers and runoff variables were identified as statistically significant in one of the four catchments examined - albeit in the catchment with the longest runoff record. There was some evidence that the monthly runoff from three small catchments subject to differential grazing pressures supported a correlation between high grazing densities and large runoff volumes during the summer months, but this result was not substantiated by modelling daily storm hydrographs for those same months.

All the hydrological data examined post dates the period of major environmental degradation, which may have contributed to the moderate results obtained. Several severe droughts between the 1880s and 1920s resulted in abnormally large numbers of stock being depastured on the Bogong High Plains in addition to the usual numbers, which contributed both to the degradation of the vegetation cover and an increase in erosion. The hydrological data for which trends were apparent coincided with the period of controlled grazing activity when total numbers of grazing stock declined from 9000 to just over 3000 cattle. The fact that runoff volumes declined between the 1940s and the 1980s suggests that there has been an improvement in the environmental conditions of the Bogong High Plains since grazing controls were introduced, but it is not certain whether full recovery has taken place, or ever will.

Spatial and Temporal Pattern in the Grazing of Grasses by Sheep within a Semi-Arid Wooded Landscape

K.C. Hodgkinson, CSIRO Division of Wildlife and Ecology, PO Box 84 Lyneham ACT 2602
J.W. Terpstra, CSIRO Division of Wildlife and Ecology, PO Box 84 Lyneham ACT 2602 (present address: Hondelaan 20, 9626 TB Schildwolde, Holland)
W.J. Muller, CSIRO INRE Biometrics Unit, GPO Box 1666, Canberra ACT 2601

Grazing has reduced the amount of grass, especially palatable perennial grass, in Australia's semi-arid woodlands and other wooded rangeland types. Reduction in grass level, coupled with fewer fires, has fostered increase in woody plants.

A study was made of the spatial pattern in the grazing of perennial grasses to better understand what controls the grazing pressure imposed on grass plants. Grazing of plants when forage was scarce and when it was abundant were compared. From the information collected a model was constructed of the factors controlling defoliation of individual grass plants in heterogeneous wooded landscapes.

Grass plants of two perennial species differing in palatability, woollybutt and mulga Mitchell grass, in two paddocks, one lightly and the other heavily-stocked with hogget sheep, were measured at the CSIRO Lake Mere Research Facility, near Louth in north-western NSW. Marked tillers were examined at weekly intervals to determine if they had been eaten.

No preference was shown for previously ungrazed plants and only occasionally were previously grazed plants preferred. Mulga Mitchell grass plants were preferred over woollybutt. Landscape zones receiving runoff water and nutrients were preferred for grazing but the effect was weak. The level of other herbaceous plants in the immediate vicinity of a grass plant did not influence the number of tillers grazed nor the probability of the plant being grazed. Overall the grazing of individual plants by the sheep was weakly determined by landscape location, stocking level, plant species and prevailing forage on offer. The influence of spatial and temporal variation was small; random grazing of grass plants was the rule in this

heterogeneous landscape. This finding suggests that the grazing pressure on palatable perennial grasses in the paddocks of semi-arid woodlands will be similar across wooded landscapes and that spatial variability in plant mortality could be due to the combined effect of plant water stress, which varies spatially and temporally, and grazing pressure which varies temporally but not spatially.

Assessing Options for Farming Systems Transitions in New Zealand's Mountainlands

Barney Foran, Semi-Arid Lands Research Group, Landcare Research, PO Box 276, Alexandra, Otago New Zealand (present address: CSIRO Wildlife and Ecology, PO Box 84, Lyneham ACT 2602)

Bruce Allan, Pasture Systems Group, AgResearch, PO Box 60, Lincoln, Canterbury New Zealand

We explore the gap between what is technically possible in integrated pasture management and what might be feasible or practical in the real world. The farming systems in the mountainlands of the South Island of New Zealand are based on the integration of intensive pastures on better soils and more extensive native rangelands. Climatic risks can be due to drought in summer and snow in winter.

The growing season is typically short and erratic. To cope with these conditions pasture scientists had developed an integrated pasture management system which provided fodder all year round in the paddock, and minimised the need for mechanised fodder conservation. However, this technically feasible and attractive system had never been adopted by high country farmers to any real extent. To understand this quandary, we used RANGEPACK HerdEcon to explore a large number of pathways by which the integrated system could be progressively implemented over a 3 to 10 year period.

All of these relied on decreasing fodder conservation and using the financial savings to offset the cost of the new system. It took at least 8-9 years for the new system to break even with the financial performance of the unchanged farm running under the same climatic sequence. Where the fodder conservation part of the enterprise was of lower cost, the transition to the newer system took 20 years or more to break even.

Biological risks such as failures in pasture establishment and lower animal performance due to climate effects increased the time to break even, as did business risks of lower product prices and higher interest rates. Given the complexity of the transition process and the possible financial risks involved, it is no wonder that farmers found it difficult to consider implementing the technology. Economic reality does not tell the whole story however, as some farmers in the mountainlands make extraordinary efforts to implement better systems of grazing management.

The challenge for pasture science is to overcome the economic barriers to new pasture technologies, while helping farm management to evolve in an increasingly complex set of

political, social, technical and market opportunities and restraints. The period in which this system was developed emphasised increases in stocking numbers as the best index of technical success. In retrospect our disciplinary focus and static thinking led us to underestimate the threat which climatic variability posed to the stability of the pasture system.

Do Australian Sheep Blowflies, *Lucilia cuprina* (Diptera: Calliphoridae), Breed in either Feral Goat or Sheep Carcasses in a Semi-Arid Environment?

D.F. Cook, WA Department of Agriculture, South Perth WA 6151

E.C. Steiner, WA Department of Agriculture, South Perth WA 6151

I. Watson, WA Department of Agriculture, Gascoyne Research Station, Carnarvon WA 6701

I.R. Dadour, WA Department of Agriculture, South Perth WA 6151

As part of the Feral Goat Eradication Campaign, 183,000 (1992) and 170,000 (1993) feral goats were shot on pastoral properties in WA and their carcasses left to decompose in the field. Animal carcasses provide a regular breeding ground for many species of blowflies, hence pastoral landholders became concerned that the Australian sheep blowfly (*L. cuprina*) may be able to breed in the feral goat carcasses. A study was therefore initiated on semi-arid pastoral land, with feral goat and sheep carcasses being exposed to insect attack each month for a year. Native blowflies were by far the most abundant species developing from virtually all carcasses, in particular the hairy maggot blowfly (*Chrysomya rufifacies*) and the small hairy maggot blowfly (*Chrysomya varipes*). Sheep blowflies (*L. cuprina*) were incapable of developing from egg to adult on either feral goat or sheep carcasses during any month. Fly trapping each month only caught *L. cuprina* adults from September to December, whereas *Chrysomya* species were trapped all year. *L. cuprina* and *Ch. rufifacies* adults are very similar in appearance, hence it is easy for pastoralists to assume that green blowflies on feral goat carcasses are sheep blowflies. However, this study clearly shows that sheep blowflies are unable to complete their life cycle on either feral goat or sheep carcasses in the area around Carnarvon, Western Australia. Hence pastoralists can be reassured that the slaughter of feral goats in this area will not result in an increase in sheep blowfly numbers.

Identity, Lifestyle and Survival: Value Orientations of South Australian Pastoralists

J.H. Holmes, Department of Geographical Sciences and Planning, The University of Queensland, Brisbane QLD 4072
P. Day, South Australian Farmers' Federation, PO Box 6014, Halifax St PO, Adelaide SA 5000

Australia's rangelands are experiencing a rapid shift from dominantly commodity values towards a mix of commodity

and (broadly defined) amenity values. The former hegemony of pastoralism is now being displaced by a diverse array of resource uses, strongly influenced by national aspirations concerning Aboriginal land rights, preservation of biodiversity and of valued semi-natural landscapes, sustainable management, tourism and recreation.

This diversification in resource value is fostered by the highly differentiated value-orientations of influential interest-groups, including Aboriginals, welfarists, conservationists, pastoralists and a disparate array of tourists and recreationists. Simplistic modes of resource allocation are being replaced by complex, often contradictory modes of politicised decision-making, shaped by the demands of interest-groups, with decisions being focussed more on values than on facts. Accordingly, more effort needs to be spent in developing an understanding of value-orientations and their influence on the perceptions, needs and expectations of these various groups.

A postal survey of 67 South Australian pastoralists reveals that they comprise a cohesive reference group with a strong sense of identity and self-worth. They closely identify with their distinctive way-of-life and its equally distinctive (and challenging) environment. They are very conscious of their role, not only as producers, but also as custodians of the rangelands, capable of making the pivotal decisions towards sustainable management. Their strong orientation towards intrinsic, expressive and social values provides partial compensation for continuing economic and social hardships. Above all they place high value on their independence, and they regard intervention by conservationists, urban interests, Aboriginal interests and governments as presenting a greater threat to their future than does prospective further economic decline.

This distinctive value orientation has for long proved highly adaptive in ensuring survival in periods of economic and environmental stress, but may be less effective in meeting emerging challenges in which pastoralism has to adjust to a more complex decision context, in which other interest groups have values and goals markedly at variance with those held by pastoralists.

The Impact of Herbivores on Regeneration in Four Trees from Arid Australia

Tony D. Auld, NSW National Parks and Wildlife Service, PO Box 1967, Hurstville NSW 2220

The size distributions of populations of four semi-arid perennial trees were investigated within Kinchega National Park in western NSW. For *Acacia ligulata*, *A. loderi* and *Alectryon oleifolius*, it appears that regeneration has been eliminated or at best severely limited at some sites. Some regeneration has occurred through recruitment of vegetative suckers in *Casuarina pauper*. Currently these vegetative recruits have high survival rates under both rabbit and kangaroo grazing, although such grazing frequently reduces the height of vegetative recruits back to ground level. Survival of seedlings of *Acacia ligulata* was very limited, with highest survival

when mammals were excluded. There was no survival of seedlings of *Casuarina pauper* in the presence of rabbits and survival was poor when rabbits were excluded. Many seedlings of both species die through desiccation. These patterns appear to be widespread in the very low rainfall areas of Australia, while they contrast with the successful regeneration of unpalatable woody shrub species in parts of the semi-arid areas of central NSW and Queensland.

Management of populations of long-lived perennials is currently passive. Given the level of regeneration failure found across many species, control of rabbits appears an essential goal if regeneration is to be re-initiated. While kangaroos will destroy some seedlings there is no evidence that they are eliminating recruitment in populations. However, as sheep, cattle and goats may eliminate recruitment, some consideration must be given to the total grazing pressure that is applied to arid and semi-arid lands. Recruitment of perennials is likely to be most favourable in wet years, while these recruits can be eliminated before or during the next dry period when other forage becomes scarce. It is during these dry periods and the lead up to them that overall grazing pressure should be reduced. For livestock this would entail spelling areas during dry periods and not maintaining high livestock numbers by hand feeding. For rabbits and goats, widespread control of populations is desirable. Kangaroo numbers will themselves be controlled by available forage in droughts, while fencing of watering points may help reduce the overall carrying capacity for kangaroos in arid and semi-arid lands.

Recruitment Characteristics of the White Cypress Pine (*Callitris glaucophylla*) in Arid South Australia

J.L. Read, PO Box 150, Roxby Downs SA 5725

Callitris glaucophylla is a long lived tree which has had limited spasmodic recruitment in the South Australian arid zone in recent years. Domestic stock and rabbit grazing have been implicated as major factors limiting its regeneration. This study assessed the influences of grazing and water relations on the recruitment of *C. glaucophylla*.

The survivorship of *C. glaucophylla* seedlings, which germinated following flooding rains in March 1989, was monitored at three rabbit densities, with and without the protection of tree guards. All of the monitored seedlings which did not receive supplementary water, succumbed to desiccation within 18 months of germination, despite above average rainfall during this period. Water stress, rather than grazing, accounted for the failure of the 1989 recruitment event. Although grazing does not appear to have had significant direct effects on *Callitris* recruitment, secondary effects such as removal of shading ground cover or altering fire regimes may be important.

An analogous study of the demography of established *C. glaucophylla* groves was compared with historical rainfall records. Successful widespread regeneration of *C. glaucophylla* in the Roxby Downs region was largely restricted in the past 60 years to three, two-year periods with consistent above average rainfall.

Vth IRC (SALT LAKE CITY, UTAH) AND RANGELAND MANAGEMENT IN USA

Report on a 1995 ARS Travel Grant

Rodger Tynan, Department of Environment and Natural Resources, GPO Box 1047, Adelaide SA 5001

The International Rangeland Congress started with a grand parade of *The Days of '47 Celebration* recalling 1847 when the Mormon pioneers entered the area which was to become Salt Lake City. This parade included police motor bikes, horses, carriages, marching, bands and all the other ingredients of a colourful procession. The mid congress entertainment featured the Bounty of the West Banquet with local bush tucker (including bison). This was followed by a country-music concert with Michael Martin Murphy singing cowboy songs. Townsville has a high standard to maintain.

The IRC was well attended by Australians, with 54 posters or papers being presented by people from this country. The Australians were strong in Session 4 (social sciences) and Session 10 (ecological aspects). Sessions 3 and 8 had a total of 69 posters and as the sessions were run concurrently, there was very little time (less than a minute!) to view all posters in both sessions. I have summarised my perceptions into broad themes based on the congress and my experience visiting US Forestry Service and Bureau of Land Management offices in Nevada, Idaho and Utah.

Land Administration

Most of Nevada and Utah is public land administered by the Bureau of Land Management (BLM) or the US Forestry Service (USFS), which are federal agencies. Grazing privileges (permits) are issued to ranchers to graze these public lands, generally for 10 year periods. The number of livestock permitted to graze is established each year and this necessitates a lot of on-ground monitoring and utilisation studies. The process is open to appeal by both ranchers and third party groups such as environmentalists. There are extremes on both sides, with ranchers suing the BLM for underestimating the number of cattle that can be run and the environmental groups challenging decisions to graze cattle at all. In Nevada, government offices have been bombed by extremist groups.

At the congress, Steve Daniels from the Oregon State University gave an interesting talk on the social and political forces shaping rangeland management in the USA, and highlighted various movements such as *Home Rule* and *Wise Use*. There are strong cultural values linked to the rangelands and Daniels considered there is a mistrust of government stemming from Vietnam, Bay of Pigs and Watergate experiences. There are many different pieces of legislation that apply to the rangelands, covering issues such as endangered species, wildlife, soil erosion, wild horses and burros, multiple use and wilderness. This has resulted in a cumbersome process in the development of environmental impact assessments for each public parcel of land. Litigation is common and many BLM officers I visited considered that a large portion of their time was spent in court.

"I don't enjoy it anymore" was a comment that I heard many times. Environmental groups were considered very professional and used the legal process to ensure government agencies carried out legislative requirements.

The trend to multiple use (or abuse) and changing community values suggests that we (in Australia) should adopt a broader focus in our management to include monitoring of biodiversity, which covers wildlife habitat and endangered species, and the effects of land uses such as tourism, rather than focusing predominantly on livestock production. Policy and politics will change a lot quicker than ecology, and community values also shift, meaning that management for the future involves trying to focus on a moving target. The focus therefore needs to be on ecological processes and how various existing, proposed and as yet unknown, land uses may affect these. David Tongway, John Ludwig, Geoff Pickup, Steve Morton and Mark Stafford Smith are a few CSIRO names that have provided some direction in this area. The National Rangeland Management Strategy due for publication soon may provide broad policy guidelines, and the next Biennial Conference of our Society at Port Augusta should provide fuel for debate regarding future management issues. It is then a simple task of finding enough money and resources to carry out the unanimously agreed strategies and monitoring techniques!

Wildlife and Livestock

I attended the *Wildlife and Livestock Ranching* field tour which visited Desert Ranch, an 80,000 ha property owned by the Church of Jesus Christ of Latter-Day Saints. This property formerly ran only sheep but now supports 4400 cows, 3000 yearlings and 2700 ewes. The grazing system follows an intensive short-duration scheme where cattle are grazed on less than 10% of the range at any one time, thereby spelling 90% of the property. A paddock is grazed by approximately 850 head of cattle for ten days and is then spelled for the next 250 days. The cattle are conditioned to move to another paddock upon hearing a bell ring. (If only my four-year-old was that easy to manage!) The pastures comprise mainly black sagebrush with a mixed forb and grass understorey and structurally resemble our bluebush community. Gullies where snow accumulates support quaking aspen. The property's elevation ranges from 1900 to 2650 m and the ground is covered with snow from December through to April.

Most of the income for the property comes not from domestic livestock but from wildlife resources, through the charging of hunting fees. Domestic livestock are carefully managed to manipulate forage availability for elk, mule deer, moose and pronghorn antelope. Hunters pay up to \$US8200 to hunt elk. Two biologists are employed to monitor the rangelands and manage the wildlife and livestock. In addition to domestic livestock, the ranch supports 2000 elk, 3500 mule deer, 75 moose and 500 pronghorn antelope plus many birds, fish and reptiles.

Controlled burning is practised in some areas to manipulate pastures and promote grass growth, although wildfires still occur. Aerial re-seeding with native and exotic grass species

is also carried out after fire to avoid bare ground and minimise runoff. Small dams are constructed adjacent to the tracks to intercept track runoff.

This part of my tour highlighted the need to focus on the timing and duration of grazing rather than total animal numbers. The Americans have a good understanding of the morphology of rangeland plants and their response to grazing intensity. The use of domestic livestock as a management tool to manipulate forage so as to favour wildlife is well suited to some American ecosystems, but requires careful management. Infrastructure also needs to be considered for wildlife management: for example, fences should not be higher than 1.1 m so that mule deer can jump them in snow conditions.

I also visited several ranches in the vicinity of Salt Lake City in company with BLM staff. Recent management efforts have concentrated on riparian areas and the value that these areas have for wildlife habitat. Inappropriate grazing of cattle on riparian areas has resulted in reduced vegetation cover, stream bank erosion and slumping, higher water turbidity and shallow stream depth; all of which were considered undesirable for freshwater fish species. Fenceline contrasts between some private and public (BLM) lands were evident with the private lands being severely eroded.

Wild horse and burro management was a major component of management in Nevada, with the BLM mustering some 8000 head annually and shipping them to the eastern states for adoption at \$US165/head. Shooting horses is out of the question in the USA.

The US sheep industry is in bad shape, with most ranchers turning to cattle. Coyotes are considered a major problem in some areas and no Dog Fence exists as in Australia. The US Sheep Experimental Station in Idaho has been evaluating the use of various sheep guard dogs, llamas and burros as protectors of sheep flocks.

Ecological theory and rangeland monitoring

Australia is certainly at the cutting edge in the refinement of ecological concepts. The traditional paradigm of Clementsian succession still underpins the interpretation of rangeland ecology by field workers in the BLM and USFS. Having now seen the classical elevation and disturbance factors operating in Utah it is not difficult to appreciate why this is so. However, the point was made at the IRC that once monitoring data are in the public arena, they can become *cannonballs* to be interpreted differently by the various interest groups. For example, BLM data collected to determine livestock impact on the land was being interpreted in a different context by environmental groups.

New methods are now being introduced which attempt to incorporate multiple use criteria rather than focusing on aspects of range condition that suit mainly cattle grazing. The focus is on ecological processes and monitoring rangeland health - described as being healthy, at risk, or unhealthy. Concepts such as state and transition, stable states and thresholds underlie modern thinking and interpretation of nonequilibrium dynamics. I recommend the publication *Rangeland Health -*

New Methods to Classify, Inventory, and Monitor Rangelands (National Academy Press, Washington DC, 1994) for a detailed account of these new methods. It is difficult to envisage how the new methods will be implemented by field staff given recent budget cuts, litigation, existing work loads and a requirement to consult with a large number of interest groups.

From the IRC, it is clear that David Tongway's and John Ludwig's joint work on soil evaluation is well recognised. The Kiwis (with help from Ocky Bosch) gave a down-to-earth presentation on how monitoring and research should work to satisfy local community needs. The South Africans have progressed with the interpretation of nonequilibrium theory in relation to management of livestock by traditional societies. They have incorporated the adoption of local knowledge and experience and the need for livestock mobility. Imported technologies and perceptions were regarded by some as being inappropriate for traditional societies. The African experience should alert us to the importance of different cultural values and perceptions when dealing with diverse cultural groups. For example, traditional Aboriginal perceptions of wildlife differ significantly from European values and animals such as the rabbit conjure up a vastly different set of values. This is an important aspect when considering biodiversity value and the bush tucker industry.

At a more practical level, the relocation of waters from paddock corners to more central locations was considered undesirable in Israel when considering plant and animal refugia. This management issue is common to Australia where many early waters were located at the common corner of four adjoining paddocks - this being the cheapest water distribution option. Piping water to the centre of a paddock may be good for animal production but may degrade wildlife habitat value, as the area beyond the normal grazing range of stock is reduced. Wildlife management information and incentives need to be provided to pastoralists to foster habitat retention and control of predators.

To Sum Up:

The IRC was efficiently organised and, in the main, well run. However, the large number of posters in some sessions gave little time for viewing or discussion with the authors.

My tour to the US has broadened my experience of rangelands and given me a greater appreciation of the roots of traditional succession theory. I have made valuable contacts with BLM and Forestry staff that will provide a basis for information exchange in the future. Most importantly, the visit provided insights into how the management of wildlife and domestic livestock can be integrated - which is an important focus for the future of South Australia's rangelands.

I thank the Australian Rangeland Society for providing funding assistance to attend the IRC and to liaise with BLM and Forestry Service staff.

(Ed. Rodger was very reticent to admit to being a fan of Michael Martin Murphy. I hear tell that he purchased one of Murphy's cassette tapes at the mid Congress concert and then played the one tape to his family during an ensuing 5000 km car trip through the US rangelands. Sounds like grounds for divorce to me!)

USA RANGELANDS (AND OTHER THINGS) Report on a 1995 ARS Travel Grant

David Orr, Tropical Beef Centre, Box 5545, Rockhampton
Mail Centre, QLD 4702

Annual Meeting - Ecological Society of America

The Annual General Meeting of the Ecological Society of America was held at Snow Bird, Utah from 30 July to 3 August in the week following the International Rangeland Congress. The theme of the conference was "The transdisciplinary nature of ecology" and was attended by over 2500 ecologists.

With up to 20 concurrent symposia, oral sessions and poster sessions, I found this meeting to be simply overwhelming. Nevertheless, by carefully studying the program, it was possible to attend sessions of particular interest to me. These included "plant reproductive ecology", "plant demography", "fire in semi-arid/arid ecosystems", "fire ecology", "plant population ecology" and "effects of herbivory on plants".

Most of the presentations were of 10 minutes duration with a further 5 minutes for questions. Presentations were from both researchers and students and covered a range of results, from dating the frequency of forest fires to predicting the recruitment of grasses from a water balance model.

Many of the presentations were academic in their perspective with little direct practical application. Despite this, it was interesting to follow the direction of plant ecological research being conducted in America.

American Institute of Biological Sciences

I attended a symposium "Population Biology of Grasses" which formed part of the annual meeting of the American Institute of Biological Sciences from 6 to 10 August in San Diego, California.

This symposium covered a range of topics, from seed ecology through seed dispersal and ecological aspects of sex expression to defoliation and morphological responses to grazing. I presented a paper entitled "Does lack of rainfall or lack of seed limit the recruitment of *Heteropogon contortus*" to provide an Australian perspective on grass population ecology. Because of the focus on grasses, I found much of this symposium to be directly relevant to my own research. In particular, the greater importance of tiller recruitment versus seedling recruitment in the persistence of American grasses contrasts with the Australian situation where more or less continuous seedling recruitment is necessary for species persistence.

The papers presented at this symposium, plus others from a range of international authors, are currently being prepared for a book entitled "Population ecology of grasses". This book is

to be edited by G. Cheplick and published in 1997 by Cambridge University Press. It will present a comprehensive interpretation of the literature dealing with population ecology of grasses throughout the world.

Jornada Experimental Range

The Jornada Experimental Range is a 78,266 ha experimental station within the Chihuahuan Desert located near Las Cruces, New Mexico and run by the USDA Agricultural Research Service. This experimental range is classified as semi-desert grassland but contains a complex of vegetation types, ranging from pure stands of grass through to almost pure stands of shrubs. Maintenance of vegetation cover and woody weed encroachment are major problems for grazing management.

One of the current research activities is determining the effects of "stressors" on ecosystem processes. Evidence of deterioration was apparent including loss of vegetation cover, which had led to soil erosion and the establishment of "islands of fertility", and the expansion of woody weeds.

The continued persistence of existing perennial grass tussocks is clearly important in the Jornada environment since I was told that there is little recruitment of the preferred perennial grass species. Accordingly, little attention has been paid to the dynamics of the soil seed bank, although some research is currently being undertaken in this area.

Konza Prairie Research Natural Area

The Konza Prairie Research Natural Area is a 3,487 ha area of Tall Grass prairie in the Flint Hills of Kansas. The area is owned by The Nature Conservancy and is managed for ecological research by the Division of Biology, Kansas State University.

A primary objective is the management for conservation of tall grass prairie and a major component of the research is the study of the effects of burning and how it interacts with grazing management. Watersheds are burnt annually, or at 2-year, 4-year, 8-year or 20-year intervals. Although grazing has been traditionally conducted with cattle, bison were introduced in 1987 and graze part of the area.

I was very impressed with the spirit of cooperation in which a range of disciplines were studying the dynamics of the tall grass prairie ecosystem. From soil microbiology through agronomy to animal production, ecosystem dynamics are being researched in a highly coordinated manner.

Australian ecologists have tended to study either burning or grazing management separately and little research attention goes into integrating the two areas. My visit to Konza has given me new insights into my own research.

Long-Term Ecological Research Program

Both Jornada Experimental Range and Konza Prairie Research Natural Area are strongly supported under the American Long Term Ecological Research (LTER) program. I could not help but be very impressed by the LTER program, which is supported by the National Science Foundation (NSF) and funded by federal tax dollars. The NSF recognises that many ecological phenomena take decades to reveal themselves and has undertaken the LTER program in an attempt to ensure adequate levels of support for analyses of these types of processes.

Given the nature of vegetation change in Australia, we as ecologists can only envy this LTER program and we should examine ways in which we could instigate a similar program in Australia.

Thoughts on the International Rangeland Congress, Salt Lake City

Brian Walker made a comment in his Resource Synthesis address about the disproportionate number of ecological versus sociological papers in *The (Australian) Rangeland Journal*. The general intent seemed to be that we need more sociologists rather than more ecologists. Furthermore, he called for greater recognition of multiple use of rangeland and quoted how little, in dollar value, grazing contributed to the overall Australian gross domestic product.

There were two invited papers that I thought deserve mention. One by Edith Allen, University of California, Riverside, raised the general topic of the role of soil mycorrhiza in soil processes and in rangeland restoration. The other paper by Walt Whitford was about "litter critters" and their role in maintaining soil processes for plant productivity.

Little research has been conducted in Australia on the function of soil micro-fauna and these two papers were interesting in that they stressed how important these functions are in rangeland processes. Despite the importance of these populations, little research is currently being undertaken in these areas in Australia. Given that we are increasing our knowledge of the dynamics of our plant communities, it would be good to see more research addressing the topic of below-ground processes.

NEWS FROM WESTERN NSW BRANCH

Russel Harland, Branch President, Department of Land and Water Conservation, PO Box 307, Cobar NSW 2835

Things have been quiet on the western front. For the past year the branch has basically been inactive. I guess this year will determine whether there is sufficient interest to keep it going. This branch first formed following the 1992 Biennial Conference held in Cobar - a successful conference which gave the Society an elevated profile in the region. Our branch facilitated the attendance by some Western NSW pastoralists to the last national conference in Katherine and we have plans for similar sponsorship to assist locals to attend the Port Augusta conference. There is some support amongst members for hosting a workshop in Cobar (either before or after the Port Augusta conference) - where the roads from Queensland intersect the east-west highway. More on this later in the year if it gets off the ground.

Using some of the profits generated from the Cobar conference, our branch co-sponsored the planting of native grasses at the local museum. There have been some problems obtaining the correct signage but the garden, complete with grass transplants, is thriving. Once fully complete it will assist some of the thousands of travellers who visit the museum each year to gain an understanding of the valuable role that native perennial pastures play in this region and to recognise them.

Members of the branch will shortly receive a letter informing them of an Annual General Meeting. We hope to combine this with an "ideas" workshop to give members the opportunity to influence our future direction.

The past couple of years have been turbulent for rural industry with low prices and drought forcing change in a number of sectors. It is understandable that people have not had the time or energy to devote to outside interests during this time. I would argue that our local branch, and the Australian Rangeland Society more generally, have a lot to offer members if they care to take advantage of it. I hope that support for the branch is forthcoming and it can serve an active function for its membership. The response to the AGM and ideas workshop will be used as a guide to the branch's future role.



*Native grasses featuring
at the Cobar Museum*

UPDATE FROM ARS STATE BRANCH, SOUTH AUSTRALIA

Merri Tothill, Primary Industries (SA), PO Box 357, Port Augusta SA 5700

Whilst the main focus in 1996 for our branch is organising the biennial conference, the branch resolved at its last Annual General Meeting to keep the branch going. Members believed it was important to maintain some continuity once the conference has passed. The Society also has a pivotal role in the development and acceptance of the National Rangeland Management Strategy. It is also a good sounding board for a balanced view on rangeland issues. Therefore it is important to keep the branch structure in place.

Activities for 1995, apart from arranging the conference, included another successful Plant Identification Course run in conjunction with the Middleback Field Centre. Another 12 people have graduated with excellent skills and confidence in this area. The branch maintains an interest in developing rangeland education programs and hopes to work together with other community groups and agencies to run further related courses. The branch has also given financial support to the University of Adelaide prize giving and has donated an annual prize for Rangeland Management and Ecology.

The future of the Rangeland Management and Ecology course which is offered through the Department of Environmental Science and Rangeland Management (Roseworthy Campus), University of Adelaide appeared to be under threat in 1995. It has been reinstated by Des Coleman with assistance by current and former students,

The current state branch committee includes the following people:

Chairperson: Martin Andrew
Secretary: Merri Tothill
Treasurer: Anne Collins
Committee: Jason Ferris, Andrew Nicolson, Dionne Maywald, Vicki Linton, Caroline Ireland, John Maconochie and Jenny Bourne.



AN UPDATE FROM THE WA BRANCH

Don Burnside (ex-President) and Hugh Pringle (Secretary/Treasurer), c/- Agriculture Western Australia, 3 Baron Hay Court, South Perth WA 6151

We held our once-every-three-years "Biennial" General Meeting on 21 February. Below is a summary of proceedings.

President's Report: Don Burnside

We have become the WA Branch rather than the West Gascoyne Branch over this period, which has seen quite a bit of activity, but not as much as we hoped or planned for.

We commissioned a survey of urban beliefs and values for our rangelands, contributing \$1,500 with \$3,000 from the National Landcare Program (NLP). Sue Nicholls from Murdoch University undertook the survey as part of a Masters degree, which is nearly completed.

We contributed to the National Rangeland Strategy without the Commonwealth support offered to other voluntary organisations. We must be more energetic in obtaining funding support to put our "Speaking for the Rangelands" slogan to work.

We also provided a submission to the WA Environmental Protection Authority on the use of 1080 for feral goat poisoning, prepared a position paper on Kangaroo Management and provided input to the Rangeland Policy Working Group.

We also held interesting get-togethers discussing diverse topics such as the private lives of eremophilas and land tenure.

We haven't put together comprehensive policies for Western Australian rangelands as we proposed to do back in 1993. We were both too busy and under-resourced. We must either lower our aspirations, or make a concerted effort to obtain funds for community development from bodies like NLP.

Should we retreat back to traditional "range management" issues (a sentence to a slow death perhaps?) or should we try to develop into an influential lobby group? I much prefer the latter course.

Thanks to Hugh Pringle for organising most functions, good luck to him with his PhD commencing at the Australian National University after Easter.

Thank you and best wishes to all WA members and visitors who have participated in our activities in recent times.

Secretary's Report: Hugh Pringle

I hope my mind isn't as disorganised as my paperwork for the ARS over recent years - good luck to my successor. We have had a reasonably steady membership with around eighty

financial members, including approximately thirty pastoral members. Unfortunately, our activities have been very much Perth-centred due to costs of travelling, although we have tried to get them to coincide with returns to school, PGA meetings and the like. I think the next committee faces the challenge of maintaining the Society's relevance to people in the bush. We are a "bush-focussed" organisation and cannot become too urban-based. More non-government members' participation in Perth will be a positive step.

The new committee members are:

President	John Morrissey (Agriculture Western Australia)
Secretary:	Ken Leighton (Department of Land Administration)
Treasurer	Dr Noelene Duckett (Agriculture Western Australia)
Committee Members:	Dr Guy Richmond (BSD Consultants) Dr Mike Roderick (Curtin University) Kerry O'Connell (Dames and Moore - consultants) Jan Foulkes-Taylor (Yuin Station)

Don Burnside closed the meeting by circulating a Position Statement on Rangeland Sustainability circulated for comment by the (WA) Environmental Protection Authority. We then moved to a larger auditorium for a session with the following speakers/topics:

Mr Rod Williams, Implementation Team Leader, South West Queensland Strategy. Rod described the land use planning project well under way in South West Queensland.

Mr Brian Gabbedy, Agriculture Western Australia. Brian discussed the Gascoyne/Murchison regional planning initiative.

Mr Keiran McNamara, Director of Nature Conservation, Department of Conservation and Land Management. Keiran discussed Conservation in the Rangelands - the challenges and opportunities.

Mr Lou Kelly, Chairman of the Pastoral Board Western Australia. Lou discussed proposed amendments to the Land Act regarding pastoral lease conditions and Native Title.

The session was particularly well received and discussion had to be terminated as we ran out of time. Common threads included:

- stakeholders are increasingly prepared to negotiate/compromise
- community participation is essential and as initiatives proceed, government should increasingly play a supportive, rather than driving, role.

All the best to the new committee and thank you to all participants for a rewarding and interesting couple of years.

SOME THOUGHTS FROM THE PRESIDENT

Ron Hacker, ARS President, c/- NSW Agriculture, PO Box 865, Dubbo NSW 2830

A belated Happy New Year to all members of the Australian Rangeland Society!

In the last RMN I indicated that plans were in hand to appoint the Organising Committee for the VIth International Rangeland Congress to convene in Townsville in 1999. I am pleased to announce that the Committee has now been appointed and has commenced the task of organising what will no doubt prove to be a milestone in the development of rangeland art and science in Australia. The Committee is chaired by Professor Brian Roberts of the University of Southern Queensland, who will be well known to many ARS members, and includes:

- Gordon King (University of NSW)
- Tony Grice (CSIRO, Townsville)
- Andrew Ash (CSIRO, Townsville)
- Ken Hodgkinson (CSIRO, Canberra)
- David Freudenberger (CSIRO, Canberra)
- David Eldridge (NSW Dept of Land and Water Conservation/Macquarie University)
- Don Burnside (Agriculture WA)
- and myself, representing the Council of the Society.

I would like to record my thanks on behalf of Council, to all Committee members and their organisations, for their commitment to this task. Of course, there will be much more work to do than can be handled by this central Committee which represents only the convenors of the various proposed sub-Committees. Convenors will be contacting many of you, in due course, to participate in the organisation and I hope that you will be able to give of your valuable (and, I know, limited) time to help make this Congress the outstanding success that I promised the Vth IRC in Salt Lake City it would be.

Of more immediate importance for our Society is the Draft National Strategy for Rangeland Management (NSRM) which should have been released for a five month period of public comment by the time this Newsletter goes to press. The Policy Working Group, established by the last (WA) Council, compiled a detailed submission to the NSRM Working Group in response to the Rangelands Issues Paper released in 1994. The Society must now respond to the Draft Strategy. Council and the Policy Working Group will be responsible for coordinating development of the Society's response. I urge all Branches to convene meetings to discuss the Draft Strategy as soon as possible, and develop an appropriate contribution to our overall response. Where we have no branch structure individuals are urged to make a similar contribution and to contact the Secretary (Bill Tatnell) to obtain a copy of the Draft Strategy and associated Summary if necessary. Council and the Policy Working Group will be able to consider submissions from Branches and individuals received up to **15 May**.

It is vital that we respond to the draft Strategy, but such responses do little to lift the public profile of the Society. Your Council is concerned to raise the Society's profile, and fulfil our motto of "Speaking for the Rangelands" by issuing public

statements on matters of major importance to rangeland use and management. I hope that by the time this Newsletter goes to press we will have released our first statement, on the rabbit calicivirus. However, there are many other national or major regional issues on which the Society, as the major national body representing expertise in the science and art of rangeland management, could and should state a position. I am therefore extending an invitation to Branches and individuals to identify such issues to Council whenever they become aware of them. We may not always be in a position to develop a statement but we, together with the Policy Working Group, will certainly give all issues serious consideration.

FRIEDEL HONORED FOR OUTSTANDING ACHIEVEMENT

News Release from the Society for Range Management

Dr Margaret H. Friedel, Alice Springs, N. Territory, Australia, received the Outstanding Achievement Award at the Society for Range Management's International Meeting in Wichita, Kansas, February 14, 1996. The Outstanding Achievement Award is presented by the Society for Range Management for outstanding achievement to members and other qualified individuals and groups working with rangelands.

Dr Friedel is one of the world's leading range scientists and her achievements and contributions are significant. Her research has had far-reaching implications throughout the world. Dr Friedel's concept of "thresholds" of environmental change, backed by solid field data, has led to increasing recognition amongst researchers and ecologists of the often irreversible nature of landscape-level changes on rangelands.

Her 1991 threshold paper in the *Journal of Range Management* is widely cited in that and other major scientific publications world-wide. In the US, her threshold concept was the basis of the "Site Conservation Threshold" developed by SRM's Task Group on "Unity in Concepts and Technology". It also played a major role in the National Research Council's 1994 publication on "Rangeland Health". In Australia, she has influenced ground-based monitoring of rangeland condition. The procedures developed by Dr Friedel and her colleagues have been widely adopted for research on ecology and management of arid zones and the sampling methodologies are widely sought by managers and scientists throughout the world.

World-wide, Dr Friedel's travels to Southern Africa, Europe and the US, and the sharing of her scientific and management expertise have broadened the perspective of both scientists and managers. Her leadership and active roles in past International Rangeland Congresses, including her current position of Chair of the Continuing Committee, have contributed significantly to the success of these Congresses.

(Ed. Congratulations Margaret. I am sure all members of the Society join with me in extending sincere congratulations to you on being awarded this prestigious honour.)

MORE ON THE 9TH BIENNIAL CONFERENCE

Merri Tohill, Primary Industries (SA), PO Box 357, Port Augusta SA 5700

The Australian Rangeland Society represents a coordinated body of people who have a common interest in the rangelands. Currently that interest base is widening as we witness the emergence of multiple use and stewardship in the rangelands of the world. This move requires all stakeholders to challenge and evaluate the economic, cultural and social values of themselves and others. ARS recognises the importance of providing an interactive forum to encourage this process and has dedicated the 9th Biennial Conference to "Focus on the Future" ... the Heat is On!!

The conference aims to:

- discern new and emerging opportunities for our rangelands for the year 2010;
- determine likely needs for policies, research and technologies;
- identify the skills and expertise required to meet these needs; and
- develop strategies which take into account future trends, yet allow for uncertainty.

To achieve these outcomes, we will be drawing on the expertise of delegates from around Australia and overseas. We expect delegates will come from a diversity of backgrounds, including pastoralists, government agencies, conservationists, Aboriginal people, mining companies, tourist operators, students, academics, consultants and agribusiness.

Delegates will work in groups to develop detailed scenarios for the rangelands in the future. The groups will draw on information from:

five "vision" speakers addressing community, conservation and production values,
six invited papers each addressing a key issue, and
background papers published before the conference in the next *Range Management Newsletter*.

A highlight of the conference will be an Open Forum for the presentation of new ideas in short papers. The speakers have been selected from abstracts already received. Delegates will also have the opportunity to participate in the challenging final session where group scenarios will be presented and discussed and strategies for the future formulated.

There will also be the choice of three field tours, two full day and one half day:

- mining, pastoral management and research in the chenopod shrublands,
- multiple use and alternative use in the Flinders Ranges, or
- local attractions of Port Augusta.

The conference organisers would also like to acknowledge the valuable contribution of our sponsors, especially our major sponsor, Western Mining Corporation, Copper Uranium Division.

If you haven't already received your Registration Package, please contact our Registration Officer; Jason Ferris, PO Box 820, Kent Town SA 5071, Tel 08 362 5536 or Fax 08 362 5537. We look forward to seeing you at this exciting conference and participating in the planning for the rangelands into the 21st century.

HISTORIC WOOL SAMPLES A Barometer of Vegetation Change!

Bradd Witt, Eugene Moll and Robert Beeton, University of Queensland, Gatton College, Lawes QLD 4343

There are few methods available to accurately retrace the dramatic vegetation changes that have occurred in the mulga country since the introduction of stock. However, sheep were sampling the vegetation long before scientists and land managers began to monitor the rangelands. Wool records aspects of a sheep's diet, in this case, the stable carbon isotope ratio of the vegetation concerned. By analysing the ratio of stable carbon isotopes along a staple we can determine the proportion of C_4 and C_3 plants in a sheep's diet. This information supplies a proxy of the sheep's diet.

Our results shown in the graph are for a single staple from Currawinya National Park in south west Queensland, an area where most grasses are C_4 and all trees and most shrubs are C_3 . (Note that a pure C_4 diet would produce a carbon isotope ratio in the range between -11 and -14, while a diet consisting of only C_3 plants would range between -25 and -28.) Summer growing periods are indicated by the peaks (around March-April) while winter browse and herbage consumption is shown by the troughs. Growth of the staple ends in September 1995 and is estimated to date back to the middle of 1991. The three dry years from 1992 to 1994 have more negative values indicating a limited amount of available grass. The period estimated to be 1995 indicates a much more favourable season.

We are seeking historic wool samples from known locations and years. Samples from last century and early this century which came from the rangelands would be ideal. If anyone knows of such samples we would like to hear from you. We only require very small amounts of wool for the analysis.

If you can help, please contact one of us by:

Phone: (074) 601 321 or (074) 601 108

Fax: (074) 601 324

E-mail: bwitt@jedi.uqg.uq.edu.au

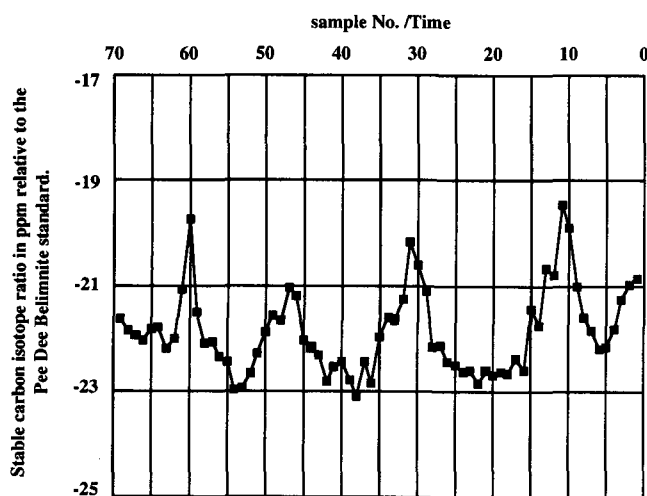


Figure 1. Stable carbon isotope ratio of a staple of wool from the Currawinya National Park. The graph represents wool growth, as a proxy of diet intake, from about mid 1991 to September 1995.

BOOK RELEASE

The Biology of Australian Weeds

Edited by R.H. Groves, R.C.H. Shepherd and R.G. Richardson
ISBN 0 646 25956 3

Sixteen of Australia's worst weeds are reviewed in this newly published book. These plants are responsible for significant land degradation and threaten farms, waterways and park land. They contribute significantly to Australia's weed costs of over \$3 billion per year.

The Biology of Australian Weeds is an essential text for research staff, students, consultants, naturalists and others interested in weeds and the environment. This book is based on a series of papers by some of Australia's foremost weed scientists, that were first published in the *Journal of the Australian Institute of Agricultural Science* and more recently in *Plant Protection Quarterly*. The papers, published over a period of 14 years, have been brought up to date by either the original authors or by other highly qualified researchers.

This detailed text was edited by three of Australia's leading weed scientists, Richard Groves, CSIRO Division of Plant Industry, Canberra and Ros Shepherd and Bob Richardson both from the Keith Turnbull Research Institute, Frankston.

Each weed is reviewed in considerable detail and information on its name, description, history, distribution, habitat preferences, growth and development, reproductive processes and hybridisation, population dynamics, importance in Australia, legislative restrictions and methods of management are examined in detail. The reviews are complemented with line drawings, maps, graphs and photographs.

The weeds described in this book are problems over a wide variety of areas in Australia. Alligator weed (*Alternanthera philoxeroides*), water hyacinth (*Eichhornia crassipes*), hydrilla (*Hydrilla verticillata*), salvinia (*Salvinia molesta*) and cumbungi (*Typha domingensis* and *T. orientalis*) are weeds of aquatic areas; ripgut and rigid brome (*Bromus diandrus* and *B. rigidus*), skeleton weed (*Chondrilla juncea*) and cutleaf mignonette (*Reseda lutea*) are weeds in cropping situations; nodding thistle (*Carduus nutans*), saffron thistle (*Carthamus lanatus*), Paterson's curse (*Echium plantagineum*), St. John's wort (*Hypericum perforatum*), serrated tussock (*Nassella trichotoma*) and Noogoora and Bathurst burs (*Xanthium occidentale* and *X. spinosum*) are weeds of pastures; budda (*Eremophila mitchelli*) is a woody weed of rangelands; and mimosa (*Mimosa pigra*) is a highly invasive weed on the flood plains of northern Australia.

This book is printed on quality paper and is section sewn for strength. With 314 pages, it is conservatively priced at \$59.50 plus \$10.00 postage in Australia and \$25.00 postage overseas. Prices are in Australian dollars.

The Biology of Australian Weeds is available direct from the publishers R.G. and F.J. Richardson, PO Box 1108, Frankston VIC 3199, Australia (Phone +61 3 9787 3804, Fax +61 3 9775 4245, email r.richardson@dce.vic.gov.au).

BOOKLET RELEASE

Exotic Woody Weeds and their Control in North West Queensland

Nathan March, Department of Lands, PO Box 7, Cloncurry QLD 4824

Exotic weed invasion has emerged as one of the major land degradation problems of northern Australia. In north west Queensland, in particular, weeds such as prickly acacia (*Acacia nilotica*), rubbervine (*Cryptostegia grandiflora*) and mesquite (*Prosopis* spp.) already cover millions of hectares of rangeland.

These weeds cause a variety of problems to land managers including reduced grass production, changes in pasture composition, stock hygiene problems, and watering and mustering difficulties. These problems are compounded by environmental concerns including loss of wildlife habitat, desertification and providing a harbour for feral animals.

To help address the problem a comprehensive booklet titled *Exotic Woody Weeds and their Control in North West Queensland* has been compiled. The booklet provides information on the origin, ecology, distribution and control options for these plants. Eight pages of colour photographs are also included for identification purposes.

The booklet will be of national interest due to the close proximity of some of the weeds to the Northern Territory, South Australian and New South Wales borders.

The booklet was produced by the Department of Lands and the Cloncurry, McKinlay, Richmond and Flinders Landcare groups under National Landcare Program funding.

This booklet of 60 pages will give interested people a thorough background to the threat posed by these exotic invaders and provide them with up to date techniques for their management.

Copies of the booklet can be obtained from the Queensland Department of Lands at a cost of \$5.00. Please make cheques payable to the Department of Lands and send to:

Nathan March
Department of Lands
PO Box 7
Cloncurry QLD 4824
Telephone: (077) 421404 or Fax: (077) 421715

NEW MEMBERS

Tony Webster-Smith
226 A Fremantle Cres
Dampier WA 6715

Northern Regional Development Board
2 Mackay St
PO Box 1762
Port Augusta SA 5700

Dr P.C. Price
LWRRDC
CTPO Box 2182
Canberra ACT 2601

Mrs Jenny Bellamy
306 Carmody Road
St Lucia QLD 4076

Philip Holmes
41 Kulgoa Rd
Pymble NSW 2073

Jamie Lees, Dept. Land & Water Conservation
PO Box 248
Walgett NSW 2832

Frank Marshall
PO Box 1544
Katherine NT 0851

Robert D. Aisthorpe
QDPI PO Box 282
Charleville QLD 4470

Chris Wicks
1 Belle Avenue
Armidale NSW 2350

Douglas Lillecrapp
"Todmorden Station"
PMB 55
Alice Springs NT 0871

Mr Mick Quirk
c/- QDPI
PO Box 967
Charters Towers QLD 4820

Serials Department
Ellis Library
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Colombia MO 65201 USA

Steve Christie & Helen Wood
PO Box 420
Longreach QLD 4730

Michael Boyce & Co c/- Tony Quirk
139 Macquarie St
Dubbo NSW 2830

AUSTRALIAN RANGELAND SOCIETY MEMBERSHIP APPLICATION FORM

Please complete and return to the Subscription Secretary, Rob Richards, PO Box 235, Condobolin 2877 NSW.

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of [address]

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..... Postcode

apply for membership of the Australian Rangeland Society and agree to be bound by the regulations of the Society as stated in the Articles of Association and Memorandum.

I enclose \$..... for full/part* membership for an individual/institution* for the calendar year 1996.

* delete as appropriate

Signature..... Date.....

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Institution or Company -			
Full (Journal + Newsletter)	\$80.00	\$90.00	\$100.00
Part (Newsletter only)	\$40.00	\$45.00	\$50.00

Note -

Membership is for the calendar year 1 January to 31 December. All rates are quoted in AUSTRALIAN currency and must be paid in AUSTRALIAN currency.

For Office Use Only:

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Date Entered in Member Register.....

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