The Australian Rangeland Society

RANGE MANAGEMENT NEWSLETTER
An official publication of The Australian Rangeland Society
ISSN 0812-4930

Citation
The material in Rangeland Management Newsletter has not been subject to peer review and may not be acceptable to some editors.

If cited it should be in the form:
Bastin, G. and Allan, G. (2012). After the smoke has cleared: 2011 fire in Central Australia. In: Range Management Newsletter (Ed. N Duckett). 12/2:3-6. (Australian Rangeland Society: Australia).

ISSN 0812-4930

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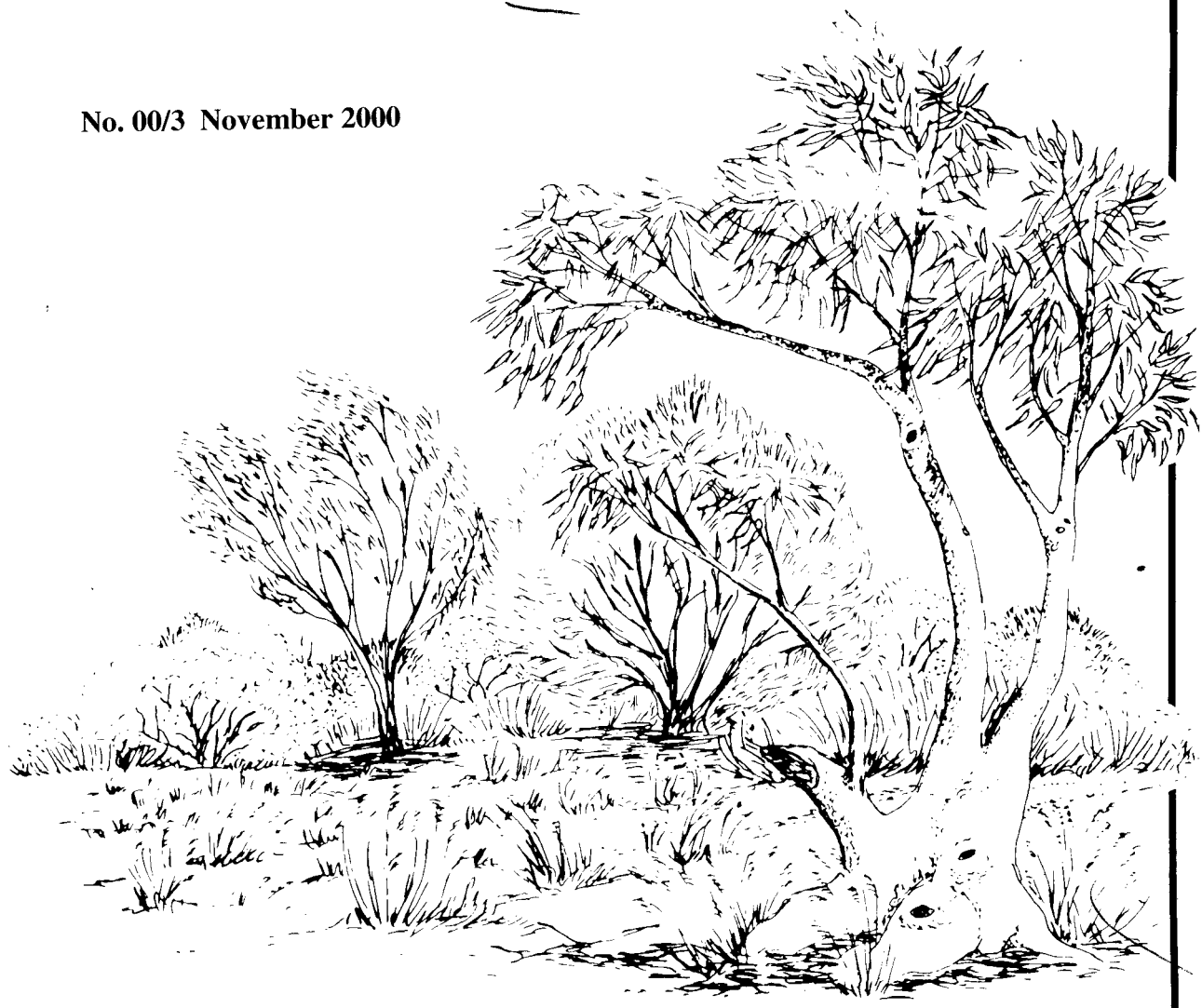

Registered by: Australia Post - Print Post No. 545270/00001

No. 00/3 November 2000

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FROM THE EDITOR

Noelene Duckett, 5 Amery Street, Ashburton VIC 3147

Welcome to the final newsletter for this year. This issue begins with two important articles outlining some exciting new changes for the Australian Rangeland Society. These changes are proposed in response to declining memberships and general Society dissatisfaction. Merri Tothill's article summarises several of the ideas which have been suggested including changing the Council format from state-based to one with representatives from across Australia. Council has also suggested several strategies for re-invigorating the Society including developing a communication plan which includes an ARS website, a special email address for member feedback and also access to special member-only on-line databases. Rob Richard's article explains the new student menbership rates and also a way for new members to receive free membership to the society. These are all exciting initiatives from Council which I am sure they would like to receive feedback on.

Several research articles have also been included in this newsletter. Andrew Thomson reports on a nine year cattle production trial undertaken in the southern shrublands of Western Australia. This study provides good information on herd performance through a range of seasons under traditional and modern management. Adam Vine and David Eldridge highlight some of their findings on rabbit control in western New South Wales. Their results suggest that "following the release of RCD (Rabbit Calicivirus Disease), physical destruction of warrens is essential to prevent reinvasion by rabbits and reactivation of warrens". Additionally, Judy Bean has presented some interim results on the effectiveness of using brush piles and 'crocodile' imprints for restoring native perennial grasses.

The other major article is a summary of the 'Yarn' session run very successfully at the recent Biennial Conference. This session featured seven 'elders' who provided a great picture of how the country had changed over their lifetimes. Christine Campbell, Simon Campbell and Greg Curran spent many hours condensing the 31 pages of transcript into the colourful and interesting article presented in this issue. I am sure you will find it a very enjoyable read.

As usual, this issue contains a number of other short articles of interest to readers including reports from the recent ARS Biennial Conference and the Northern Grassy Landscapes Conference. One article that I would like to draw your attention to is the one promoting the 2001 Eureka Prizes – Australia's pre-eminent national science awards. There are 13 prizes on offer in a wide variety of fields. Perhaps you know someone that you think deserves a nomination.

I am once again on the lookout for items for the next newsletter so let me know if you have an article to contribute. You can contact me at the above address, by telephone on 03 9885 6986 or via email at nduckett@ozemail.com.au. The deadline for the next issue is mid February.

FROM THE COUNCIL - A BOLD PLAN FOR ARS!

Merri Tothill, Vice President, PO Box 357 Port Augusta 5700.

The current SA Council has been busy considering the current state of the Australian Rangeland Society, the feedback received at the Broken Hill Conference and other subsequent feedback.

The following presents our response to the concerns of our members, in the form of a **Bold Plan for ARS – a truly national body**.

In the plan we propose:

- Some changes to the current Council format;
- Clarification of the role of Australian Rangeland Society; and
- Some strategies to re-invigorate the Society (also see the following article by Rob Richards).

We need to hear your comments on the proposals – are we on the right track? Let us know by replying through the special email address, set up for this purpose - range_reply@hotmail.com

Changes to Council

Proposal

That Council includes 7 members, to reflect the national, inclusive and skills based membership.

Discussion

ARS is a National Body, it should have a National Council, made up of membership from each state. This may provide an opportunity to the Victorian and Tasmanian rangelands.

Strengths of this approach:

- Spread responsibility for decision making and action more evenly across membership;
- Opportunity to maintain continuity of Council membership and Council members can develop skills and profile;
- Limit the loss of corporate knowledge that occurs every two years as Council moves from state to state; and
- Less pressure on smaller (population and membership) states to take on the "whole of Council" role.

Weaknesses include:

- Difficulties in managing day to day administrative procedures.

However, we believe that this concern maybe overcome through good communication and a clear definition of Council member roles. The current Council also needs to hear from "founding" members as to the reason for originally moving the Council from state to state.

Key criteria for Council membership should include:

- Membership of Australian Rangeland Society;
- Business management skills;
- Geographical/regional spread;
- Experience and understanding of rangeland industries;
- Environmental expertise/experience;
- Strong links to all stakeholders/understanding the needs of diverse stakeholders; and
- Desire to contribute to the Society.

Term of the Council – 2 year rolling membership, with half turnover, maximum of 4 years.

Unique role of ARS

Proposal
To provide a forum for free interchange of ideas and information among people with interests in the rangelands.

Discussion
The role is based on our understanding of what ARS does that other groups or individuals cannot or are unable to do. It is what we do best and reflects how others see us.

Strategies

These relate to the "themes" referred to in Rob's article. Council is still working on developing these and their associated actions.

Following is the list so far (not in any order of priority):

Identity/marketing

- Hold regional forums on specific issues and disseminate outcomes to range of relevant "clients";
- Liase and establish regular links with the media;
- Develop and disseminate promotional materials; and
- Sponsor and promote Council approved events.

Communication

- ARS website
- Specific email address for member's feedback and information exchange
- Access to online database of member's expertise available to members only.

Membership incentives – outlined in detail in Rob's article.

Business/Financial Plan

- Initial financial assessment
- Determine costs of implementing strategies
- Determine priorities
- Develop tenders as required.

Value Adding to Conferences

- Develop a mentoring system for new members/students with rangeland "champions"
- Invite guest speakers to address specific "themes" eg mining, tourism
- Relate "themes" to sponsorship packages
- Rewards for excellence in presentations/posters in different categories
- Establish a student forum for presentations during the conference
- Have 3 rates of conference registration – members, students and others.

Product Development

- New brochures/posters
- New logo!!
- Merchandise for sale eg ties, shirts, stubby holders, bumper stickers.

Student/professional package

- Includes some of the membership incentives
- Develop a code of ethics/set of standards that incorporate the Society's values.

Lets hear what you think – please give the current Council some assistance.

We look forward to hearing from you on email range_reply@hotmail.com

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GREAT NEWS FOR EXISTING AND NEW ARS MEMBERS

Rob Richards, Subscription Manager, PO Box 235 Condobolin NSW 2877.

As discussed with members at the Broken Hill conference, SA Council has been busy focussing on reshaping the future of the Society. The membership drought is breaking and the SOI (Sensational Other Incentives) is positive. Council is putting together a package of incentives/rewards for new and existing members of the Society. These are articulated in a series of themed strategies that Council has devised (see previous article by Merri Tothill).

Within the "Membership incentives" theme there is a package of financial rewards for members such as reduced ARS conference registration fees and increased scholarship funding available.

Additionally, there is also a scheme where your membership the following year is absolutely FREE if you introduce five new members to the Society. A list of participating members in the scheme and the number of new members they have introduced will be printed in the November Newsletter each year (see below). You must ensure that the new member you have introduced indicates on their application form whom they were introduced by. Council must remind participants that no anti-social or drug inducements are to be used in persuading new members. We have one participant already off to a great start - go Watto, three to go!!

Within the "Student Package" there will be student membership rates and a range of conference benefits such as a "mentoring" system and student forum.

The new student membership rates (for an individual or family) commencing immediately will be as follows:

	Australia	Overseas Airmail
Full (Journal+Newsletter)/Student	$65/$50	$85/$65
Part (Newsletter only)/Student	$35/$30	$45/$35

As indicated by Merri in the previous article, Council will also be proud to unveil the future of rangelands communication within the "Communication" theme. Members will be part of the first *e*-rangelands communication package including rangeland databases, chat room and web site.

Membership Rewards Scheme

Member	New Members Introduced
Ian Watson	2

Exciting times are ahead for the Australian Rangeland Society. Our members are our strength.

OTHER NEWS FROM COUNCIL

The National Council recently announced two changes to its personnel. Robyn Cowley was recently elected to Council as the Northern Territory representative (Council is due to move to the NT after being in SA). Robyn's contact details are as follows:

Robyn Cowley
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PO Box 1346
Katherine NT 0851
Telephone: 08 8973 9749
Fax: 08 8973 9777
Email: robyn.cowley@dpif.nt.gov.au

Vivienne Van Mook has also been elected to Council as Treasurer following the resignation of Craig Baulderstone. Viv's contact details are as follows:

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THE CUNYU DEMOGRAPHIC STUDY (1990-1998)

Andrew Thomson , Natural Resource Management Group, Natural Resources, Forestry and Development Division, URS Asia Pacific, 20 Terrace Road, East Perth WA 6004

Whilst much is known about the productivity of cattle grazing in the tropical and sub-tropical savannahs and woodlands of Australia, information about cattle production in the semi-arid rangelands has been limited. That is, until the results of a study in central Western Australia were published earlier this year.

Cunyu Station, situated in the mulga shrublands of Western Australia's Southern Pastoral Region, was the site for a nine-year project that recorded a wide range of production based information. Specifically, the work has provided an opportunity to observe herd productivity under a range of extremes in seasonal variability, and incorporates recordings from an initially traditional pastoral Shorthorn (*Bos taurus*) herd of approximately 2,500 head. Four management activities in particular, were examined:

1. Vaccination for botulism;
2. Weaning;
3. Mustering efficiency and its impacts on productivity and management; and
4. The impact of sales strategies and resultant herd re-structuring.

Land systems

Cunyu station is located approximately 80 km north east of Wiluna, and comprises 372,400 ha of a range of land systems and pasture types, most of which are relatively common to the Southern Pastoral region. Extensive salt lake systems throughout the centre of the property provide a matrix of saltbush/bluebush country interspersed with sand dunes, acacia thickets and palatable semi-perennial grasses and herbage. These areas are preferred by the cattle and, following good rains, are excellent country for fattening. The balance of the property consists of ancient alluvial sands with mulga hardpan and wanderrie banks carrying palatable acacias, shrubs and semi-perennial grasses.

Some areas of the property, which in the past have supported sheep grazing, contain extensive undulating iron stone plains with very few useful perennial plants. These areas have a very low carrying capacity for cattle. Only about 15 per cent of the total area of the property is useless for grazing stock. These areas include the stony hills and the salt lake beds.

Climate

Rainfall averages 236mm and the median is 212mm per annum, but as typical in all arid rangeland areas, there is a wide variation around the average. Historically, 60 per cent of rainfall occurs between February and May, which stimulates valuable perennial growth providing beneficial top browse and annual and perennial grasses through to the

following summer. Winter rain if received, falls in June and July, and produces short-lived but highly nutritious annual herbage. Rainfall and seasonal descriptions during the period of the study are recorded in Table 1.

During the course of this study, two drought periods were experienced, one in 1990-91 and the other in 1993-94. The first drought occurred at a time when herd management reflected a 'traditional' style of animal husbandry. There was no vaccinating for botulism, little or no weaning, and a predominance of older cattle in the herd. In contrast to this, the second drought period occurred when new management practices were in place. These included vaccination for botulism, weaning, selective culling of cattle, and a strong emphasis on minimising the grazing pressure applied by feral animals and kangaroos.

Data recorded during these two periods has provided an opportunity to compare and contrast modern management practices with more traditional methods of cattle management.

Table 1. Rainfall and seasonal conditions (1990-1998).

Year	Rain (mm)	Timing of rainfall	Seasonal Condition
1990	229	early summer rain	Poor
1991	98	winter rain	Drought
1992	357	autumn/winter rain	Very good
1993	132	winter rain	Poor
1994	79	no significant rain events	Drought
1995	395	summer rain	Good
1996	269	winter rain	Fair
1997	370	summer rain	Good
1998	269	winter rain	Fair

Infrastructure

Functional infrastructure on Cunyu Station was scarce when the current managers took over the lease in 1990. Watering points did not provide grazing access to the whole property, and were in poor working order. There were no facilities with which to undertake any sort of weaning program, and the few cattle yards that existed on the property were in disrepair.

Since that time, there has been a very strong focus on the development of such infrastructure. This emphasis has played a critical role in lifting the productivity of the herd, and the subsequent profitability of the business.

The key activities have included the development of eight new watering points with windmills and pipelines in those regions of the station where cattle were originally unable to graze without surface water being present. Water-trap yards have been installed in eight locations; all of which have square mile electric paddocks adjoining them. These yards assist with the mustering process, allowing cattle to be handled at eight locations instead of four. They also facilitate weaning programs, ensure that all cattle are handled within 12 kilometres of where they are mustered, and increase the ease with which sale cattle can be assembled.

Current management practices

There is no subdivisional fencing on Cunyu, so cattle are free-range and remain unsegregated. Consequently, bulls are always with cows. Most cattle have definite home areas, and after rain events, they disperse well away from the windmills onto claypans, creeklines and some large freshwater pools, which may last for up to eight months.

Mustering is carried out by two musterers with four wheel drive vehicles. In some instances a plane is used in which case an extra two to three musterers are recruited. Cattle are culled heavily for horns and temperament, and sales are targeted at 400-420 kilogram steers as baby or two tooth animals into the domestic trade, or more recently into the live export trade. In reality, a large percentage of sales fall outside of this range as a result of season, birth date, or mustering efficiency. On average, female cattle comprise more than one-third of the numbers sold.

Weaning takes place at most musters, and those calves that are separated from their mothers are trucked about 20-40 kilometres away from the region in which they were mustered. They are handled at least four times during the weaning period to quieten and educate them, and spend around 10 days in the electric holding paddocks before being released.

Vaccination for botulism also occurs at each muster with those animals not having been mustered previously that year receiving a bivalent vaccination. Calves are vaccinated at marking if larger than 50 kilograms in weight, and re-vaccinated if mustered again during their first year.

What has the study shown us about cattle grazing in the semi-arid rangelands?

Indicative herd performance statistics derived from the Cunyu Study

The Cunyu study provided a wide range of data that has made it possible to assess herd performance under traditional and modern management regimes. It has also given us the opportunity to observe this herd performance through a range of seasons. Some of these performance statistics are shown in Table 2.

Table 2. Indicative herd performance statistics derived from the Cunyu study

Herd performance under traditional management practices in WA				Herd performance under modern and improved management practices			
Seasonal conditions	Good	Fair	Poor	Seasonal conditions	Good	Fair	Poor
Mortality rates (%)				Mortality rates (%)			
Females	10	-	35	Females	5	5	10
Steers	7	-	25	Steers	5	5	8
Bulls	5	-	20	Bulls	2	2	12
Unweaned steer calves	25	-	30	Weaner steers	3	7	7
Unweaned heifer calves	15	-	25	Weaner heifers	6	6	9
Sales				Sales			
Total turn-off (%)	20	-	15	Total turn-off (%)	25+	25+	25+
Females	0	-	30	Females (cull for age, breeding age, and heifers)	45	35	45
Steers	85	-	35	Steers	40	50	40
Herd/cleanskin bulls	15	-	15	Herd/cleanskin bulls	15	15	15
Average Calving %	60			Average Calving %	80		

Reducing mortalities in cattle herds

It is currently generally accepted that vaccination for botulism is an important means of reducing the losses in cattle herds in the Southern Pastoral Region of Western Australia. Antibody testing in cattle from both vaccinated and non-vaccinated herds within the region has shown that cattle are challenged by the clostridial bacteria that causes botulism.

Comparison of mortality rates for all classes of cattle during the two drought periods at Cunyu, indicates that once-yearly vaccination for botulism has played a significant role in reducing losses. The results also suggest that early interventions through animal husbandry during the first year of a drought, will contain losses in that year and the next. In the second year of a drought, however, a point is likely to be reached at which the intensity of management will not prevent continuing mortalities.

Herd segregation, and more intensive management of females in particular, may make it possible to further reduce mortalities in cattle herds grazing in semi-arid regions. To achieve this, development of infrastructure to increase the number of cows handled and calves weaned per unit area mustered, beyond current limits, must be a priority.

Weaning

Weaning is widely regarded amongst many cattle producers in the region as a time-consuming and costly management activity. Whilst extension professionals advocate it as an important management strategy, the key question is whether or not it can be justified financially.

This work provides some important insights into the benefits of weaning:

- Weaning undertaken during normal seasons and droughts in particular, will produce greater revenues as a result of achieving higher reproductive performances.
- As the intensity of weaning increases, the consistency of reproductive performance also increases. This provides greater scope to select optimum quality calves to retain in all years, not just the good seasons, and generates greater consistency in livestock quality and income.
- The Cunyu study showed that weaning assisted in lowering breeder mortality rates and therefore increased the opportunity to sell cull for age cows. Through its impact on body weight, weaning also ensures that cull breeders achieve the best possible prices and maximise income.

Weaning has a number of one-off costs associated with it, including infrastructure such as yards and paddocks. It also generates costs associated with plant and machinery, and time. Financial analysis undertaken as a part of the project write-up illustrates that despite these costs, it is an activity that will increase profitability if applied as one component in an integrated approach to animal husbandry.

The Cunyu study demonstrated that weaners over 120 kilograms will survive during drought periods on semi-arid rangelands in fair to good condition, and continue to be productive in the years that follow. Rangelands in poor condition are unlikely to produce the same results. In addition, twice-yearly cross-weaning must be undertaken in these circumstances if it is to be effective. The same outcomes may be harder to achieve in a *Bos indicus* herd if wet cows allow newly weaned calves from other areas of the property to suckle. In these instances, segregation may be necessary.

Mustering efficiency and its impact on productivity and management

Mustering efficiency underpins the effectiveness of all components of animal husbandry on a pastoral property. This was highlighted at Cunyu where key activities such as breeding programs, weaning, and vaccination, were all adversely effected when mustering efficiency was low. On average, mustering efficiency was 69 per cent.

The maximisation of mustering efficiency must be a primary objective for pastoralists striving to improve the quality of their herd and the consistency of their income. One of the ways in which pastoralists can improve mustering efficiency is to increase the frequency of musters undertaken during the year. The benefits were illustrated at Cunyu, with greater consistency in reproduction and reductions in breeder mortalities being two of the major production responses recorded.

Despite these observations, financial modelling suggests that the gains in productivity from a second muster of the whole property are not necessarily reflected in increased profitability over a once-yearly mustering program. Computerised herd modelling and financial analysis however, does not consider a number of intangible benefits which arise when twice-yearly musters are undertaken.

The increase in mustering efficiency for the year results in:

- better control of mickey bulls and breed quality;
- increased control of disease;
- a larger gene pool to select the best possible quality replacements stock from each year, as a result of consistently higher calving rates;
- increased control over the rate of genetic change during breeding programs; and
- quieter cattle as a result of more frequent handling.

Whilst a complete second muster of the property is unlikely to maximise profitability, there is no doubt that improvements in mustering efficiency, particularly within the breeder herd, will increase productivity. If these increases can be achieved at minimal cost, then the business will clearly be better off. The segregation of the breeder herd, combined with twice-yearly mustering of that group alone, would appear to be necessary.

It is also evident from this study that accurate estimations of mustering efficiency are critical to the process of making decisions on numbers of cattle that need to be sold each year. Whilst decisions on how many cattle to sell each year often tend to be a function of the level of income required, they also play a critical role in containing the size of a productive herd. Unless a pastoralist can calculate his/her true mustering percentage, any estimation of numbers that need to be sold to contain a herd at a constant level, are done largely by guess-work, and the implications for range management are significant. Electronic identification and automated herd recording technologies provide great promise in overcoming these problems.

Breeding programs and breeds

Careful observation of the Cunyu breeding program over a period of six years, shows very clearly that the process of changing breed type on a free-range pastoral property is a slow one. In this instance, Hereford genetics were being introduced to a pastoral Shorthorn herd, and it took five years to reach a point at which half the herd was infused with the new breed.

Data recorded from the herd also highlights the competition from cleanskin bulls, which will be exacerbated by inefficient musters and is a critical impediment to the process. Herd bull numbers must be large enough to compete with these old bloodlines and the emphasis in bull selection during a new breeding program should be one of quantity.

The question of which breed types are optimum for the Southern Pastoral Region is often a point of discussion within the industry. Over the last 10-20 years, the acceptance of *Bos indicus* cattle as a legitimate alternative to the traditional *Bos taurus* breeds has become more widespread. Although the Cunyu study hasn't provided an opportunity to directly compare the two, it has given us some valuable insights into the more traditional *Bos taurus* herd grazing in the Mulga shrublands of WA. In particular, it shows that a well managed *Bos taurus* herd can survive without high mortalities during drought, whilst continuing to reproduce at high rates (see Table 2). This is a significant combination. However, with reference to 1990-1991 results, it also shows that a poorly managed *Bos taurus* herd will encounter large population crashes (i.e. over 30 per cent) and reproductive failure during drought.

The impact of sales strategies and resultant herd structuring

The Cunyu study demonstrates the value of weaning and vaccination for botulism with turn-off figures exceeding 25 per cent in the majority of years of the study. Importantly though, it highlights the opportunity to gain valuable income from the sale of females, and the risks associated with holding onto older breeders. The sale of these animals would seem to be a more attractive option financially than that of increasingly uncertain reproductive performances and a growing risk of mortality as they age.

The work also shows that in a herd that does not experience population crashes, maintains consistent reproductive performance, and in which mustering efficiency is less than perfect, 25 –30 per cent turn-off will not be sufficient to contain herd numbers. With a consistent emphasis on animal husbandry as described in the report, it should be quite feasible and necessary, for pastoralists to turn-off more than 30 per cent of their herd handled in every year.

An additional point to note is that the emphasis at Cunyu is placed on selling young steers as opposed to older bullocks, which often predominate on pastoral properties managed along traditional lines. It is a strategy that should be applied on all properties whose markets pay for the production of meat. The reason being that as animals age, they increasingly divert more energy into the production of fat as opposed to protein (ie meat). Given that digestible energy is often the limiting factor in the diet of cattle grazing in the rangelands, and that liveweight gains and market prices are more a function of meat production rather than fat production, it would be reasonable to conclude that a younger herd will generate more income.

HAS THE COUNTRY CHANGED ? - A YARN WITH SOME OF OUR ELDERS

Christine Campbell and Simon Campbell, 'Norwood', Blackall QLD 4472
Greg Curran, NSW Agriculture, PO Box 459, Broken Hill NSW 2880

Introduction

The Centenary Symposium of the Australian Rangeland Society held at Broken Hill on 21-24 August 2000 built a picture of landscape issues in a historical continuum. As part of this wider view of sources of information about landscape change a session was presented on Day 2 entitled "Has the Country Changed? – A Yarn with some of our Elders."

The seven participants chosen as elders were enthusiastic and gave willingly of their time, experiences and jokes.

The 'elders' for the session were:

- Ian Crossing of 'Topar' Station via Broken Hill, NSW;
- Howie Debney, bush pilot and broadcaster, Broken Hill;
- Lois Litchfield, 'Mundowndna' and 'Wilpoorinna' Stations, Maree SA;
- John and Pam Lord, 'Thackaringa' Station, Broken Hill; and
- Maxine and Alf Withers, 'Springwood' Station, Wentworth NSW.

This group has an unbroken association with the landscape. Maxine's family came to the Wentworth area in 1854 while the Lord family commenced purchase of country around Broken Hill in 1876. Howie's father lived near Haddon's Corner in 1896 and Howie himself lived at 'Arrabury' in the Channel country and later flew over the far northwest of New South Wales, southwestern Queensland and northeastern South Australia doing aerial kangaroo counting and sheep grazing distributions. Ian's family had a butchery in Broken Hill and accumulated land around the town purchasing "Topar" in 1924. Lois has lived in Alice Springs and Birdsville as well as cattle stations near Maree.

Prior to the event, the session organiser, Greg Curran, spent time with each of the participants building an overview of their lives and discussing changes that each person had seen. Greg and facilitator Simon Campbell also met with the group to reach agreement on the best way to develop the yarn session. The session was recorded both on tape and in writing – the full transcript of 31 pages is available from Christine Campbell (simchris@b190.aone.net.au) or Simon Campbell (simoncampbell@bigpond.com).

In this article, the exact words of the participants have been used as much as possible. Direct quotes from the open session are in inverted commas, and remarks or statements recorded outside the yarn session (either as background notes to Greg Curran, or in the preliminary session with the facilitator) are written in *italics*. Many of these additional statements were of interest and added value to the formal taped yarn session.

Major Images

Five powerful images of dust, drought, rabbits, change and endurance emerged from the session. It is essential to the understanding of landscape change from 1800 to the present to recognize the significance of these themes.

The yarn session depicted lives that have been dominated by climatic events . "You'd all realise ... that weather absolutely dominates our life" (Ian). There were recollections of "savage" (Lois) dust storms that were "deep chocolate brown wall(s)" (Howie) or "soft red" (Maxine) lasting three to four days. These storms meant one had to "sweep the table before you got a meal" (Lois) and windscreens were "so pitted that they had to be replaced" (Lois) while wind turned the landscape into a *"sea of moving sand"* (Lois). Pam spoke about *huge duststorms of 1945/46 where drifting sand would sometimes derail trains.*

Droughts were remembered as occurring every twenty years or so. Alf recalls his family trucking sheep in the 1920s. "They were packed onto little trucks ... two decks ... sitting on their haunches like sardines''. In the 1940s Alf came home from school to cut scrub with axes and cart water for a "long long while." He saw "thousands and thousands of sheep die because they couldn't be travelled away ... the stock routes were dry." Howie compared the 1940s drought with that of the three dry years of 1965, 1966, and 1967. He concluded that the 1960s duststorms were not as intense as the storms of the 1940s.

Myxomatosis, introduced in the 1950s, had a major impact on the rabbit population described by John as the "biggest curse in this country." The rabbit was omnipresent in the Western Division from the 1880s to the 1950s. The decline in rabbit population set the scene for a "really remarkable" (Alf) recovery of the country when it rained in the 1970s.

All participants recognised major changes in the country following the rain events of the 1970s. "... about four times we had over 10 inches ... in that time the country got to catch up and the drifty sandhills that were the norm until then were eventually covered" (Lois). "... the state the country was in in the 'forties you'd never credit the transformation it is today ..." (John).

Personal stories were told with a wry humour which underlined the acceptance of the difficulties of life in earlier years. Alf spoke about the day when Maxine, as a young bride, found herself lost after going out for a horse ride and going out of a paddock by mistake because the fence "was sanded up." They had to search by kerosene lamp for her but she "saved her reputation" (Maxine) by finding her own way home. As a young girl from the city Pam spoke vividly of how she was introduced to the art of house keeping bush style when John left her to clean a

boundary rider's hut while he did a day's fencing. Her first encounter with a swaggie enlightened her as to the varied uses of metho. Lois described the heart of a dust storm recalling how "the sand'd ripple through the middle of the house ... like waves on a beach" and "you couldn't hear people walk into the house behind you." She described the work involved in finding and digging out the stock-water troughs when they were so buried that you could only see the damp patch on top of the sand. "You just can't imagine the work that it used to take."

These images provide background for a more detailed examination of the yarn session. Three historical periods were used in the conference to overview both the proceedings of the Western Lands Royal Commission of 1900 and the rangeland management history of the Western Division up to the present.

Early Settlement Phase (1800-1900)

The 1890s did not evoke strong memories for any member of the group nor were there any stories orally relayed by older family members to build up a comparison of climatic events and rangeland management between the droughts of the 1890s and the 1940s.

John, while saying there was little written early history of his family's properties, referred to Royal Commission papers which stated that in 1895 there were 150,000 rabbits poisoned by strychnine on 'Thackaringa'. By combining these numbers with stocking figures listed by the Royal Commission he calculated a stocking rate on 'Thackaringa' in the six years up to 1895 as equivalent to 1 sheep per acre for each year.

The error of judging the people of the 1890s by today's standards was strongly voiced by Ian. Although the stocking rates indicated by the Western Division stock figures for the 1890s were "terrible" compared with today's standard "a lot of that was caused by absolute ignorance ... those people did not have history to teach them that this country is very low stocking type country and they just overdid it." The early settlers must not be regarded as "idiots in the way they stocked the country." Ian noted that there were "few waters" at that time while John referred to pastoral leases which were four and half thousand acres upon which governments expected that people would make a living.

Audience members reinforced these comments highlighting that rabbit numbers would have been critical in terms of total grazing pressure. Another audience member raised the lack of management tools as compounding the problems of the 1890s and that developments such as motor transport, polythene pipe for water, and biological control for rabbits have lead to a better managed and more resilient landscape.

The recorded drop in stock numbers in the Western Division from a high of 13.6 million in 1891 to a low of 3.6 million in 1902, and the subsequent maintenance of the sheep numbers at an average of 6.3 million for the fify years 1903 to 1953 (46% of the maximum in 1891), is evidence of a massive rearrangement of the expectations of the rangeland managers and the government (Barnard 1962).

A significant man-made landscape change was noted by John. Enormous numbers of trees were removed from 'Thackaringa' for the smelters and for use by townspeople in Broken Hill and Silverton "... 30 to 40 drays a day would cart timber into Broken Hill during the 1890s ..." mainly mulga and belah. The plains from 'Thackaringa' to Cockburn on the SA border were originally timbered.

Middle Phase (1900-1950)

The group had very strong and cohesive memories of the terrible drought of the 1940s and the accompanying dust storms. The lack of infrastructure such as road and rail transport and water on the stock routes was exacerbated by restrictions on travel and fuel, and labour shortages caused by World War 2 (1939-1945). Many sheep died on-property. Ian's family lost all but 300 out of five or six thousand "... it was terribly difficult for them but they just seemed to cope" (Ian).

The dust storms lasted "for three or four days" which, as a young child, Howie was able to measure by changes in the view out of his school room window on 'Arrabury' in the Channel country. He could recall being able to look south down the hill from this window where there were "two bloodwood trees with an old donkey wagon underneath them and then about another 250 yards further on was the sandhill, the big red sandhill across the creek" where he played. When a southerly dust storm came he could only see as far as the trees for three or four days at a time. He commented that in flying terms this would mean three or four days that "you were not able to get into the air because of poor visibility."

There was definitely no sense from any of the participants that historically significant changes were occurring to the landscape or that there was any fundamental problem with land use. People accepted the weather as "par for the course" (Ian). "There'd been droughts before" (Ian) and that people at that time "would have been able to remember back to the 1890s and would've seen earlier droughts" (Ian). There was no sense of crisis. The Australian drought/flood cycle was accepted as normal by "people with great hearts" (Ian).

The rabbit remained a significant and controlling factor in land management with rabbits present in huge numbers all through this period. Alf felt that administrators came from Sydney, wrote papers and then left without appreciating how much the pastoralist was doing to deal with the rabbits, for example by putting up expensive rabbit proof fencing. He says that "without the rabbits there certainly wouldn't have been the devastation" (Alf). He spoke of rabbits migrating much further than the experts would admit, and of how "they bred up in the Simpson desert and came ... over the border fence and down our way and my brother and I could walk around with a stick ... you could walk a few hundred yards and kill twenty, thirty rabbits without any trouble and they also swam the Anabranch in their thousands but we didn't have any photographs" (Alf).

Adoption of the Western Lands Commission stocking rates led to a slow stabilisation of the country. John reinforced how much the rabbit contributed to the difficulties of land management. "... if we ever had any good seasons, the rabbit plagues would come through and take away any good that the rains had done." He reiterated that he was sure "that the country was stabilising itself from ... the way it was ... abused late in the last century" but "it wasn't until the rabbit went that the country really started to regenerate." John recreated his experiences with rabbits "on one tank with professional trappers ... they took twenty thousand pair in three nights." At sunset from his camp close to the tank he could see them "come in for a couple of miles ... you could see the dust that they were raising coming in to water."

Man assisted in this slow stabilisation process even if some actions were not regarded as desirable in hindsight. John began planting trees around 'Thackaringa' about the time Albert Morris and Roy Edwards began tree planting in Broken Hill. The Zinc Corporation and South Australia Woods and Forests could supply tree seedlings. West Australian drought resistant trees were used. People were urged to plant mesquite, now a declared noxious weed in most Australian states.

Late Phase (1950-2000)

Reduction in total grazing pressure combined with better property and regional infrastructure (road, rail, poly piping and the dog fence) meant that the country has changed in a number of ways particularly after the significant rain events of the 1970s. A major development was the increase in woody weeds. From his aircraft Howie has seen much more vegetation cover since the significant rain events of 1974. He noted that the increase is in "woody weeds" "five or six feet high." Vegetation cover increase was measured by such simple yardsticks as "old 30s airstrips which are now overgrown" (John). *Lois recalled that many places that either had no trees or a few sticks only in creeks in her early childhood now have very big trees on them.* There was a collective feeling that the country has "improved" and "stabilised" and the country was "put back on its feet" (John).

This increase in vegetation meant that there were more bush fires. In the summer of 1974/75 the country "just exploded into flame" commented Howie. He saw five distinct and separate bushfires between Tibooburra and Moomba. Sometimes the burnt country would be hundreds of kilometres wide when driving from Euston on the Murray to Bourke. The fires were started by lightning strike and would burn in the sand hills of the channel country for weeks at a time.

Evidence of how significant pasture change requires major rain events and subsequent favourable climatic conditions was highlighted by Ian Crossing. Much earlier in the century William Dawes, the then owner of Ian's property 'Topar', introduced Mitchell grass. However it did not spread much until the 1950s and then really thickened in the 1970s. With the most recent flood it has thickened and spread again in the light loamy soil where the saltbush used to grow. Ian feels that this is a change for the better. His observation has been that higher summer rainfall has predominated and this is favourable to Mitchell grass.

Questions on changes in flora and fauna produced a mixed response. Alf did not see "much change" in the vegetation "because it always comes back if we get a rain." However quite often unrecognised plants came after rain or endangered species such as mallee hens returned after fires. Alf was protective in this situation and felt that people often did not report sightings of rare plants and animals. Maxine noted that "we don't hear curlews like we used to thirty and forty years ago" and attributed this change to foxes and cats but as for other birds. "I think there are more and more of them all the time as we have more waters for them and they don't fall out of the trees dead in the great heatwaves like the old timers used to tell us about." Pam agreed saying that there were "twice as many birds in the garden...all sorts of birds that we didn't ever see when we were first married." Lois recalled at different times many pelicans seeking food, and nesting swans looking for water. Howie noted that in 1956 bustards were very thick "like fowls" north of Broken Hill in the area along the New South Wales-Queensland border but that they have since disappeared.

Large animals in the environment were spoken about in connection with total grazing pressure. Alf noted that emus had a large build up a few years ago and that the kangaroo population had to be monitored carefully especially in national parks. *Howie related one incident in the early 1970s when counting from the aeroplane 5 kangaroos were noted over 330 miles outside the fence and then 330 kangaroos were noted in the 130 miles inside the fence to Broken Hill.* Lois spoke of the build up of dingoes since the introduction of calicivirus which had reduced rabbit numbers. The dingoes were coming in search of other food.

Conclusions

1. The session provided both a useful record of change and a perspective on the changes that had occurred.

The elders presented a clear picture of massive landscape change and some of the driving elements of this change, all of which would be familiar to ARS members. The evidence for massive and probably irreversible landscape change to thick scrubs in the northwest of the Western Division (and into Queensland) is irrefutable and well documented, and was thoughtfully presented at the ARS conference by the historian George Main (Main 2000).

However in the southern section of the Western Division and western South Australia, the current picture presented by the elders of change since the 1890s is of revegetation of much of the landscape with reduced windborne soil movement. There is a shift in management to a more realistic approach and expectations of livestock use, and a management consciousness of the need to obviate overstocking and erosion problems. There is supporting monitoring evidence for this for some areas of the bluebush shrublands in South Australia (Maconochie and Lay 1996).

2. Indigenous knowledge still seems to be only considered "at a discount" to scientifically derived knowledge.

In his invitation to ARS conference attendees to come and participate in the "Yarn With our Elders", facilitator Simon Campbell quoted Ray Ison (Russell and Ison 1991 from Roling (1990)), saying "Such is the persuasiveness of the dominant conceptual tradition that ... we have no words for the functions to be performed in shifting indigenous knowledge and farmer influence upstream toward the science end of the science-practice continuum." "Nothing is more certain than that we are entering unfamiliar intellectual territory as when we realise that we do not have the words to talk about our experience."

Many Australian and international rangelands conferences have dealt with the nature and relevance of indigenous knowledge. While some studies have been done, the number of examples of the constructive synthesis of this local knowledge from first or second settlers with relevant scientific analysis is small. There is clearly scope for improving this point of communication for the benefit of rangelands management for any purpose.

Policy instruments would appear to have been dubiously effective in leading or driving this change. Guy Fitzhardinge noted at the ARS 2000 conference that the proceedings from the 1900 Royal Commission "might have been recorded only yesterday." However in terms of production systems, the managers of the landscape appear to have learnt from the past, have changed their practices, and believe that there is a sustainable future for pastoral activities in the central/southern Australian shrublands.

3. The cohesiveness and distinctiveness of the cultures in the rangelands is worth further formal examination

The authors plan to submit an article to the Australian Rangelands Journal, which (if accepted) could look at the intersection of the distinctive cultures that operate in rangeland management. This would concentrate on Australian pastoralists as a local variation of a global and consistent culture of pastoralists and nomadic farmers who emerged in human history around 6000 years ago.

4. There are more stories to be told, and we have only had a taste of the experience and learning lodged in people's memories.

These stories are not just about landscape change, but about second settler experience in a land which they perceived as rough and unpredictable.

The transcript of the session highlights the quiet resilience of these people in their own words. "I was born in the early 20s and it was just life ... it was dust ... conditions were harsh and ... it was something you were born into and you accepted it" (John). There was an absolute belief that they were all part of the landscape which demanded respect. "... if we don't look after it we won't be there we wouldn't be there if we hadn't looked after it anyway" (Alf) but that they could work on it and change it and that they would survive.

Final Reflections

Some final reflections by the "elders" provide us with thoughtful perspectives from those who live and work in the rangelands.

"The greatest thing is history in this country ... if we have history and experience in the countr ... if you can follow the scientific findings and try and match them the best way you can or compromise them with your own environment ... I know it's been a great help" (John).

"Everybody here must bear in mind that this country is a land of contrast ... very great contrasts" (Howie).

"We think we're so fortunate and privileged to be able to live in this wonderful country and enjoy our life here and we're lucky to be leaving it into such safe hands with our son" (Pam).

"We hear a lot of criticism from the east in Sydney about the devastation and how the Western Division should be closed ... those people forget that they're living in concrete jungles and they're covering the best and the most valuable soil in the whole country with bitumen and concrete and yet if we tell them that they're devastating the country ... we're ridiculed" (Alf).

Acknowledgments

The authors would like sincerely to thank:

- the seven elders for their generosity in being available for the day interviews, their patience with the facilitator and with an unfamiliar process on the day;
- Craig Cardwell the sound technician at the Broken Hill Convention Centre for the tape presentation and copying;
- Jes Campbell for her invaluable help with the transcription of 31 pages from the session tape.

Simon and Christine Campbell would like to thank Greg Curran who provided the concept of a yarn session and did all the preparatory 'field work'.

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BUSTING THE BUNNIES: EVALUATING RE-INVASION OF WARRENS

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Introduction

Rabbits are widely considered the principal pest to agricultural Australia. They denude and eat the seedlings of native flora, they compete with and displace native fauna for food, and they disturb the structure and stability of soil. As a result, numerous methods of rabbit control have been implemented and tested. Control is primarily of a physical (warren ripping, explosives), chemical (fumigants, baiting) or biological (myxomatosis and rabbit calicivirus disease) nature. Past investigations have shown that a control program based on the integration of these different methods is likely to have the most effective results.

Rabbit Calicivirus Disease (RCD) was released throughout the continent at various locations; some with integrated control and others not. Numerous studies have shown that ripping of warrens is the most effective method of controlling rabbits. The present scenario at Yathong Nature Reserve, a United Nations Man in the Biosphere reserve near Cobar in central-western NSW created a good opportunity to investigate the effectiveness of reactivation rates of warrens with and without ripping (physical control), combined with the release of RCD (biological control).

In order to seek answers to some of the problems of managing rabbit-infested landscapes, an integrated research program was initiated to learn more about the impact of rabbits on soils and vegetation, recovery of vegetation after the removal of rabbits, and the impact of intact warrens on the persistence of weeds. This work reported here examines the differences in reactivation of rabbit warrens following mechanical ripping and the characteristics of rabbit warrens in open areas compared with those under trees.

The study area

Yathong Nature Reserve is located approximately 140km south-west of Cobar in western New South Wales. Yathong was formerly a sheep grazing property before being declared a Biosphere Reserve. Over the past decade the New South Wales National Parks and Wildlife Service has undertaken a regular program of mechanical ripping of rabbit warrens in order to reduce rabbit numbers. Unfortunately, some warrens could not be ripped because they are in steep country, or close to trees or rock outcrops. These warrens then become refuge warrens for recovery of rabbit populations and often support weedy plant species. Yathong was chosen as a study site because of the large area of relatively open woodland and grassland and the high densities of rabbits it supported. In October 1996 the reserve was a release point for rabbit calicivirus disease (RCD). Two areas, within close proximity, were selected for the study, one that was ripped and the other left unripped, allowing us to compare differences in re-activation rates of warrens in relation to ripping.

At site A on the eastern edge of the reserve, warrens were left unripped. The vegetation community is an open woodland dominated by *Eucalyptus intertexta*, *Alectryon oleifolius,* and sparse *Callitris glaucophylla*. Warrens at Site B had been ripped about 5 years (January 1995 to May 1996) before measurements were taken using a tyned ripper pulled behind a crawler tractor. Site B is located approximately 8km west of site A in an open grassland of scattered *Callitris glaucophylla*. At the time of the survey, *Medicago laciniata*, *Centaurea melitensis*, *Erodium crinitum*, and *Sclerolaena diacantha* dominated the herbaceous layer of both sites.

At each site, 100 warrens of approximately equal size were randomly selected, and measurements made of warren size, shape and ground cover, the number of active and inactive entrances per warren, and the frequency of trees or fallen timber on the warrens (Photo 1). Active entrances were defined as those showing evidence of rabbit activity, that is freshly exposed soils, scratchings or dung, or entrances which rabbits were observed to use.

Photo 1. Measuring characteristics of rabbit warrens at Yathong Nature Reserve in semi-arid central-western NSW

Results

There were ten times as many active entrances at the unripped site (4.01 ± 0.43 standard error of the mean) compared with the ripped site (0.43 ± 0.26; $F_{1, 98}$=328.18, P<0.001). Generally larger warrens had more entrances, with an average warren occupying 400 m^2 containing between 30 and 40 entrances. The number of entrances could generally be predicted from measurements of warren size. However, as expected, we had a greater ability to predict the number of entrances from measurements on the unripped warrens (R^2=0.70) compared with ripped warrens (R^2=0.11). This was most likely due to the fact that the boundaries of the unripped were easier to distinguish than those of the ripped warrens five years after ripping.

Given that, in woodlands, rabbits often tend to construct warrens amongst the roots of trees, we expected that larger trees would support larger warrens. However we found no consistent trend of larger warrens under larger trees. Warrens out in the open generally tended to have less active entrances compared with warrens under trees or those around logs, and generally the number of entrances tended to increase with the number of logs or trees on the warren. As expected, increased numbers of active entrances were associated with reduced levels of ground cover ($F_{1, 198}$=9.16, P=0.003).

Discussion

The results indicate that at the woodland site, warrens tend to be sited amongst trees and fallen timber, and that as the density of obstructions (logs, trees, rocks) increases, warrens are likely to be larger and support more rabbits, hence the greater number of entrances. The reason for greater size of warrens under trees could relate to protection from predators, ease of digging, or the fact that the area around the base of the trees is often slightly elevated above the general landscape. The presence of large branches on some warrens indicates to us that trees previously occupied some warrens. The combination of soil disturbance by the rabbits, destabilisation of the soil surrounding the tree and wildfire typically results in the collapse of trees. In other studies, large charcoal lenses have been detected in the soil below warrens, indicating the presence of wildfires (Myers and Eldridge unpublished data).

From a management perspective, the results indicate that, following the release of RCD; physical destruction of warrens is essential to prevent reinvasion by rabbits and reactivation of the warrens. Where warrens were destroyed, there was very little re-activation of warrens, reducing the need for costly follow-up control. However the relatively high density of warrens occurring under trees in woodland sites poses serious problems for future control programs.

Warren ripping is restricted by the proximity of entrances to large woodland trees. In the Yathong study, there was an average of 12 entrances per warren for the 200 warrens studied. The outer edges of the warrens could be ripped without disturbing the roots or destroying the trees, but those close to the trunks required alternative treatments.

Apart from ripping, the most common techniques available are baiting, gassing and fumigation, and costs per warren in 1999 figures are given in Table 1. These costs have been calculated for the specific soil conditions and moderate density of trees for woodland sites. Based on an average of 12 entrances per warren, costs range from $2-$3 for 1080 poison to $6-$8 for larvicide. These rates take into account hire or purchase of equipment including the cost of the fumigant or bait, labour costs and other costs such as fuel.

Table 1. Costs of rabbit control methods based on an average 12-hole warren.

Control Method	Cost per Warren
Poison (1080)	$2-$3
Rid – A – Rabbit (LP Gas)	$2-$4
Fumigation (phostoxin)	$6
Fumigation (larvacide)	$6-$8

With similar conditions as that occurring at the open woodland site at Yathong Nature Reserve, ripping of the outer edges of the warrens would cost approximately $7-$10 per warren based on the use of a crawler tractor with an appropriate ripper. If we assume that ripping destroys only 50% of the warren entrances (ie half of them are too close to the tree to rip) follow up control is required. Using phostoxin tablets or larvicide will cost a further $3-$4 per warren, resulting in a total cost of $10-$14 per warren. Total cost per warren would of course decline in areas of high warren densities.

NATIVE PERENNIAL GRASS RESTORATION

Some observations on effectiveness of brush piles, as compared with no treatment or use of a 'crocodile'

Judy Bean, NSW Agriculture, PMB 19 Trangie NSW 2823

Monitoring in August 2000, at a research site north of Cobar in Western NSW, revealed that the number of new plants of grass was substantially higher in areas where turpentine (*Eremophila sturtii*) branches had been laid, compared to areas within seedbanks or outside seedbanks where no treatment was imposed. Areas which had been treated with a 'crocodile' (a rolling barrel with specially designed metal feet which, when pulled across an area, makes regularly-spaced imprints in the soil surface) showed the number of new plants marginally higher than in the seedbanks or non-treated areas, but substantially lower than under the brush piles. The research site is on 'Darling Downs', on hard red mulga country, with mulga oats (*Monochather paradoxa*) the prominent palatable perennial grass. The average number of new plants of mulga oats and No. 9 wire grass (*Aristida jerichoensis*) recorded in the four areas are given in Table 1.

Table 1. Numbers of new plants of mulga oats (*Monochather paradoxa*) and No. 9 wire grass (*Aristida jerichoensis*) in the seedbanks and three types of area outside the seedbanks at the 'Darling Downs' site.

Area	Average number of new plants of mulga oats per 0.5 m^2	Average number of new plants of No. 9 wire grass per 0.5 m^2
Seedbanks	0.8 (range 0-5)	1.1 (range 0-6)
Outside seedbank, no treatment	0.6 (range 0-7)	1.6 (range 0-10)
Outside seedbank, in quadrats with crocodile imprints	2.5 (range 0-35)	3.5 (range 0-42)
Outside seedbank, under branches of turpentine	16.8 (range 0-70)	15.0 (range 0-183)

The observations were made in the context of a Natural Heritage Trust/NSW Agriculture funded project which is examining the efficacy in semi-arid environments of restoring native perennial grasses using seed banks. Sites, including the one on 'Darling Downs', were set up and initial monitoring completed in November 1999. Seedbanks approximately 50 metres wide, straddling the highest portion of a ridge, were fenced to prevent grazing by kangaroos, goats and domestic stock. Running down slope away from the seedbanks, areas 20 metres wide and from 50 to 100 metres long were pegged out as treatment areas. In each set of treatments a similar sized area was left untreated as the control. At each site there are four branches treatments, four 'crocodile' treatments and four controls. The aim of the wider project is to test whether wind and water are effective agents in dispersing seed from a seed bank and allowing it to be captured in the branches and 'crocodile' imprints for germination.

Photo 1. November 1999 view of the branches treatment running in a SW direction off one of the seedbanks (in distance) at the 'Darling Downs' site. Branches in foreground are 66 m from the seed bank fence. Note mulga trees, turpentine bushes and sparse cover of grasses and forbs.

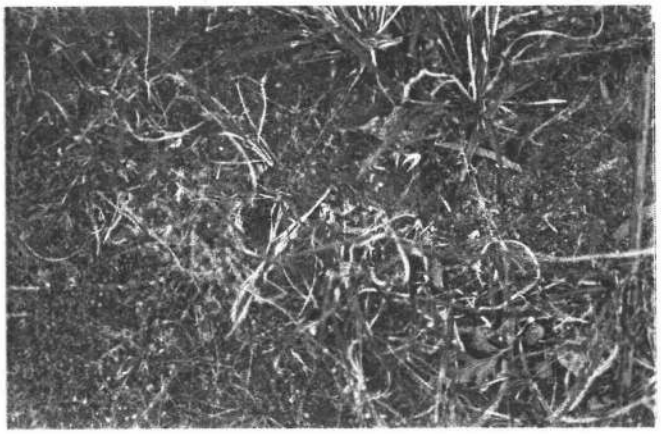

Photo 2. August 2000 close-up view of vegetation which had grown under branches at 5.5 m from the seedbank fence in the same treatment as depicted in photo 1. In November 1999 five plants of speargrass (Austrostipa variabilis) were the only grasses present. The 52 plants of mulga oats recorded in August 2000 had all grown since November 1999. The majority were located along lines where the turpentine branches had been in contact with the soil surface.

Monitoring of vegetation in the seedbanks and the areas outside the seedbanks is planned to continue until February 2002. The results over this longer period will presumably encompass a wider range of seasonal conditions and therefore should give a more reliable comparison of the effectiveness of seedbanks and the two treatments outside the seedbanks in restoring palatable perennial grasses to these western environments. However initial results do suggest that, in hard red mulga country, where the palatable perennial grasses are sparse, the laying of brush will be the more effective practice in creating an environment for development of fertile patches (Tongway *et al.* 1989). Close examination of the ground surface under the branches, showed that the majority of germinations occurred at the contact of individual branches with the soil surface. Accumulation of fine material had occurred along these lines, enhancing the microenvironment for germination.

In implementing a branches treatment in a paddock, the number and size of areas of branches that could be supported by the nutrients available in the landscape would need to be carefully considered. If the number was too high or the size of the areas covered by branches too large, the nutrients available to any one patch would be too low and therefore germination would not be effectively promoted. Conversely, if the number of patches was too low or the size of the areas covered by branches too small, then nutrients would continue to be lost to the system and new plants would continue to be restricted in number.

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REPORT FROM THE 11TH BIENNIAL ARS CENTENARY SYMPOSIUM

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The 11TH Biennial Conference of the Australian Rangeland Society was held at Broken Hill from 21 to 24 August 2000. Over 200 participants attended the "Centenary Symposium." The organising committee was very pleased with the multitude of compliments about the high standard of the conference. Typical of these was "one of the best conferences ever held by the ARS."

The conference started with an indigenous welcome and opening address by Dr Tim Flannery, Director of the South Australian Museum. A total of 39 invited and contributed papers were presented in the main forum of the conference and 45 papers presented as posters. Mid conference tours provided a welcome break to the proceedings and even some adventure as the coaches coped very well with slippery roads.

The program was planned to make the conference different from previous conferences. Issues confronting landholders and governments involved in the use and administration of rangelands were examined in discrete historical time slices. Aboriginal occupation and early European settlement through to present land use issues were examined including historical reflections to help discern futures for the rangelands.

The "Yarn session" provided a facilitated discussion by "senior" rangeland users of their experiences and frustrations as rangeland managers and service providers. Simon Campbell facilitated this session very effectively. The session was recorded and Christine Campbell has written an article for this newsletter (see earlier) and is hoping to contribute a paper for the Journal.

Papers ranged widely over biophysical, socio-economic and policy issues confronting the rangelands. Reflecting current policy were several papers on community involvement in natural resource planning, management and regional development.

Papers presented at the conference will be published in a future edition of the Australian Rangeland Journal. The Conference proceedings contains the papers presented as posters and extended abstracts of the papers presented as oral dissertations in the main forum. A limited number of copies of the conference proceedings are available for sale for $30.00, including postage and GST - contact Rob Richards, PO Box 235, Condobolin NSW 2877.

PROJECT UPDATE

(Ed. Please find following the first of what I hope will become a regular feature of the Range Management Newsletter – that of reporting about work in progress. I would encourage those of you working on projects to contribute similar reports).

Monitoring natural resource condition in south west Queensland

Delphine Bentley and Lachlan Pegler, Queensland Department of Natural Resources, Charleville QLD 4470

The Coordinated Natural Resource Monitoring Project of the South West Strategy (SWS) aims to develop and implement monitoring programs to enable the condition and trend of land resources of south west Queensland to be adequately assessed. This project is funded under the Natural Heritage Trust; in cooperation with the South West Natural Resource Management Group, SWS Enterprise Reconstruction Group, Great Artesian Basin Consultative Council, the Queensland Department of Natural Resources and the Queensland Environmental Protection Agency.

Since commencement in 1998, the project has established and re-recorded 19 permanent QGRAZE sites. These data will help to determine the long-term effect of the Enterprise Reconstruction component of the SWS on natural resource condition. Results are included in a database of sites throughout Queensland's grazing lands, which represents the state's contribution to the rangeland component of the National Land and Water Resources Audit. The field work is also used as an extension activity, by involving land managers in establishment, and recording of sites. Reports of sites on their properties are provided to them. GRASS Check, a similar system, is also used with land managers to assess the effectiveness of different management practices.

Another primary activity of the project involves evaluation of the natural resource and other implications of the Bore Drain Replacement Project (BDRP), using three concurrent programs. These include:

- detailed benchmark sites to assess trends in soil and vegetation condition and biodiversity indicators around closed bore drains and replacement water points;
- a regional assessment of land condition associated with operating bore drains in different land systems in the region; and
- a survey of land managers assisted by the BDRP to document their perceptions towards attitudinal change, natural resource management and economic issues associated with the new watering system.

The project is due for completion in March 2001, by which time reports will be complied for each sub-program. For more information, contact Delphine Bentley or Lachlan Pegler by email (Delphine.bentley@dnr.qld.gov.au; Lachlan.pegler@dnr.qld.gov.au) or phone (07 4654 4285).

REPORT FROM THE NORTHERN GRASSY LANDSCAPES CONFERENCE

Peter Jacklyn, Communications Coordinator, Tropical Savannas CRC, Northern Territory University, Darwin NT 0909

A Northern Grassy Landscapes Conference was held on 29-31 August 2000 in Katherine, Northern Territory. This followed a similar conference on southern grasslands in Clare, South Australia in 1999. It was organised by a consortium of interested parties in northern Australia and coordinated by Tropical Savannas CRC.

The purposes of the conference were twofold. Firstly to exchange knowledge and experiences in the management of northern grassy landscapes and so improve the capability to manage them healthily. Secondly it was to provide guidance and advice to agencies responsible for programs which could benefit northern grassy landscapes and those people responsible for managing and caring for them. It was a conference for practical landholders and managers, people supporting natural resource management and both government and non-government program managers and policy-makers.

The Conference was attended by 240 people with approximately equal numbers of land holders and managers, service agency people (public and private) and researchers. Conference attendees were officially welcomed by The Honorable Mike Reed, Deputy Chief Minister, Northern Territory Government and the Conference was officially opened by The Honorable Dr Sharman Stone, Parliamentary Secretary to the Minister for the Environment and Heritage, Australian Federal Government. The Conference acknowledged the Jawoyn people as traditional owners.

The Conference was a mixture of speaker sessions, large and small workshops and social activities. There were two field trips; a conservation focused trip dealing with mine site rehabilitation and biodiversity conservation and a trip to Elsey Station concerning Aboriginal pastoral, conservation and ecotourism operations.

Outcomes

The final session of the Conference involved small groups considering the future needs of the Northern Grassy Landscapes. The major needs identified during this session included:

- *integrated regional planning* - required to achieve the goal of a healthy landscape. This planning needs to recognise the aspirations and experience of a range of people and groups, and be focused on achieving sustainable, healthy landscapes.
- *cooperative action and activities for sustainable management* - needs to be integrated at the local and regional levels. All relevant stakeholders need to be included, however a cooperative approach would best be coordinated by a neutral but involved body.
- *comprehensive monitoring framework* - essential for the achievement of sustainable healthy landscapes. This monitoring needs to encompass the full range of values important to achieving and maintaining a healthy landscape.
- *conflict between production and conservation* - needs to be resolved. This will require a regional vision and approach, and also the active participation of all stakeholders and the wider community.
- *collection and communication of appropriate information* - essential to a better understanding of the issues and requirements for sustainable healthy landscapes. This requires the simultaneous use of a range of communication channels and media.
- *education* - is a key ingredient to a wider level of competence and appreciation of the importance of northern grassy landscapes and their management. It needs to be targeted and should cover both the wider picture and local application.
- *weeds* - are a major threat to the northern grassy landscapes. There is also the issue that plants introduced as improved pasture species have become weeds in certain situations and are threatening ecosystem processes. This dichotomy of views is a cause for disagreement and conflict between production and conservation sectors.

Future Activities

Possible activities which have been considered following the conference include:

- Conducting a series of Regional Forums across northern Australia with the purposes of:
  1. developing regional strategic plans for integrated conservation and production management;
  2. resolving issues of conflict between production and conservation interests; and
  3. maintaining the momentum of activities and learning supported by the Northern Grassy Landscapes Conference.

  Regional Groups already active regional planning and management should be involved in the conduct of these forums to achieve sustainability outcomes incorporating environmental protection, economic viability and social desirability.
- Broadening the scope of Property Management Planning (PMP) to include conservation management and biodiversity protection strategies and practises.
- Conducting a review of State/Territory and Local Government resource management legislation and regulations to identify aspects which are contrary to or impeding sound sustainable landscape management (including fire management, weed and feral animal management and grazing management).
- Implementing a National monitoring program for grassy landscapes incorporating production, conservation, social and cultural values. The National Land and Water Resources Audit are developing such a monitoring proposal for Australia's rangelands. The monitoring program needs to incorporate mechanisms, incentives and communication to enable landholders and managers to use the outputs of such a program in the management decision-making.

WELCOME TO THE CENTRE FOR THE MANAGEMENT OF ARID ENVIRONMENTS (CMAE)

Adrian Williams and Ed Barrett-Lennard, Centre for the Management of Arid Environments, Curtin University of Technology, Locked Bag 22, Kalgoorlie WA 6433

The Centre for the Management of Arid Environments is a collaborative venture by Curtin University of Technology, Agriculture Western Australia, the Goldfields Esperance Development Commission and the Western Australian Department of Commerce and Trade.

It has the distinction of being the first Western Australian Research Centre of Excellence in Industry Focussed Research and Development to be located outside the Perth metropolitan region. CMAE is in a perfect position to capitalise on opportunities to carry out research and teaching on the large scale in the rangeland 'living laboratory' at its doorstep.

The Hon. Hendy Cowan, Deputy Premier of Western Australia and Minister for Regional Development, launched the CMAE on 16 February 2000.

CMAE officially opened for business last October. However, the Centre and the establishment of research partners have been developing over the last few years. The staff that have been appointed to date are the Inaugural Director, Dr. Ed Barrett-Lennard, and the Business Development Manager, Adrian Williams.

CMAE aims to be Australia's leading research and teaching Centre committed to finding solutions to the environmental, social and economic issues arising out of land use in arid shrubland environments. It will improve collaboration between research workers and enhance the application of research outcomes. It will draw together stakeholders including landholders, government (local, state and federal), indigenous people, and research and teaching institutions.

The present partners in the CMAE are Curtin University of Technology and Agriculture Western Australia. Others are expected to join the Centre in future. The Goldfields Esperance Development Commission and the State Department of Commerce and Trade have played pivotal roles in the establishment of the Centre, and are represented on the Board of Management. The establishment of CMAE has been made possible through major funding provided by the Department of Commerce and Trade, Agriculture Western Australia and Curtin University of Technology.

The headquarters of the Centre will be on the Kalgoorlie Campus of Curtin University of Technology at 55 McDonald Street. Co-located in the building will be the CMAE, the District Office of Agriculture Western Australia and the Environmental Technology Section of Curtin University, Kalgoorlie. Refurbishment of this building (which has accommodation for 30 staff) will be completed in October 2000. The Western Australian Minister for Primary Industries, the Hon Monty House, will open the Building on 13 November 2000.

Curtin's Kalgoorlie campus is an ideal location for the CMAE. The City of Kalgoorlie-Boulder has a population of 33,000. It services the largest region in Western Australia including the City of Kalgoorlie-Boulder and the towns of Coolgardie and Kambalda (Shire of Coolgardie), Norseman and the Eyre Highway (Shire of Dundas), Menzies and Kookynie (Shire of Menzies), Leonora, Gwalia and Leinster (Shire of Leonora), Laverton (Shire of Laverton) and Warburton (Shire of Ngaanyatjarraku). Rangeland processes in this region are likely to be similar to those over a large proportion of the Australian continent.

The CMAE will provide training and research and development in sustainable, profitable and culturally acceptable uses of arid and semi-arid shrubland environments for the benefit of all Australians.

A key strategy to this work is the building of collaborative linkages with land users (Aboriginal communities, miners, pastoralists, tourism operators and residents) and other research organisations to build joint capability for the benefit of all concerned. Thus the Centre and its Director can promote a multidisciplinary approach to solving applied problems in systems research. The range of areas in which the CMAE and its Board see the Centre operating include:

- developing new enterprises to diversify rural economies and inject funds into rural communities;
- assisting existing industries and enterprises to be the best that they can be;
- rural sociology and rural policy;
- economics, marketing and supply chain structures;
- conserving biodiversity through environmental protection;
- landscape and general ecology in normal and modified environments;
- hydrology; water sources, storage and efficient use; and
- the rehabilitation and re-use of degraded and mined environments

The Centre will have a regional, national and international profile. It aims to be self-sustaining within the next 3-5 years, achieving financial independence through the attraction of research grants and fee for service research, teaching and training.

CMAE seeks opportunities to collaborate with departments and agencies at all levels of government, and with industry and non-government organisations to mutual benefit.

The CMAE will offer facilities for externally supported visiting researchers to:

- join temporarily a resident research team or an individual researcher, or
- carry out research of their own.

The CMAE will offer facilities and supervision for externally supported research students enrolled in Curtin University of Technology or other collaborating universities.

Three international research projects with CMAE are already established in the Goldfields. Other projects with mining companies, land conservation district committees and strategic planning groups are in progress.

CMAE is seeking sponsorship and studentships to attract high calibre students. Postgraduate research students will take part in new or ongoing research programs. We envisage that certain postgraduate students will be self-funding, whilst some international students will be sponsored by their government or by an international agency.

CMAE in association with the Environmental Technology Section of Curtin, Kalgoorlie is positioned to provide 'seamless' education from Certificate to Postgraduate levels. A further advantage to education at the CMAE is the co-location within the Centre of the Goldfields office of Agriculture Western Australia. This provides close contact between the students and those charged with administering the region's rangelands and supporting their sustainable and productive use.

The CMAE mounted a short course in Pakistan in April, and will provide further short courses in answer to perceived needs by staff of CMAE or in response to external requests. Such courses would be supported variously by the WA Department of Training, self-funded participants, or by external funds.

Further information about the wider roles of the Partner Agencies can be found at www.curtin.edu.au/ for the Curtin University of Technology, and at www.agric.wa.gov.au for Agriculture Western Australia. Shortly CMAE will launch its own website with hot links to the websites mentioned above. Further information on what CMAE may have to offer you is available by contacting either Dr. Ed Barrett-Lennard (Tel: 08 9088 6610; Barrette@kalg.curtin.edu.au) or Adrian Williams (Tel: 08 9088 6715; williama@kalg.curtin.edu.au

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WHO OR WHAT IS URS?

Don Burnside, NRM Group, Natural Resources, Forestry and Development Division, URS Asia Pacific, 20 Terrace Road, East Perth WA 6004
Martin Andrew, NRM Group, Natural Resources, Forestry and Development Division, URS Asia Pacific, 25 North Tce, Hackney SA 5069

Who is URS? That must have been the most common question asked at the recent Rangelands Conference. Don Burnside thinks it must stand for Unemployed / Unemployable Rangeland Scientists! – since he, Martin Andrew and now Andrew Thomson (ex Meekatharra) are part of this group.

Actually, it the new name for the international merger of Dames & Moore and Woodward Clyde, both multinational environmental engineering consulting companies with diverse activities ranging across the brown environment – mining – green environment – agriculture – forestry spectrum. The relevance of the acronym has been lost in the mists of time.

Our bit of it used to be AACM International, a long-establish agricultural consulting group here and overseas. More recently the 'AACM' group has focussed on natural resource management – planning, evaluating and managing projects across the natural resource management spectrum. AACM became Dames & Moore - NRM few years ago, which in turn is now part of URS.

The NRM group has a strong rangelands tradition. Examples include:

International:

- the Mauritania second livestock project (World Bank; 1986 to 1990) which aimed help Tuareg and Hassanyah pastoralists to develop rules of thumb for managing rangelands in the three rangeland zones of Mauritania (Sahara, grass savanna, tree savanna) to enable cattle numbers to be reduced whilst maintaining the overall production;
- the Kuwait Soil Survey (just finished) a state of the art GIS-based soil survey of the whole country; and
- research into rehabilitating degraded Kuwait rangeland (in progress).

Australian:

- Review of rangeland monitoring practices usable by pastoralists;
- Developing resource assessment strategies at the regional scale;
- Managing rangeland properties for mining companies;
- Aboriginal community development planning;
- Working with pastoralists to develop individual property management plans for the Willandra Lakes World Heritage Region in south west New South Wales;
- Coordinating part of the Sustainable Grazing Systems program across southern Australia, an initiative of Meat & Livestock Australia with LWRRDC, MDBC and State Agencies;
- Carbon sequestration opportunities in rangeland; and
- Evaluating producer-driven R&D projects into sustainable rangeland property management in northern Australia (in progress).

Other NRM team members with rangelands expertise include John Fargher, Charles Drew (property management), David Marston (ex NSW Soils Commissioner), Bruce Howard (a resource economist born and raised about as remote as you can get, at Wiluna) along with free-lance sub-consultants such as Andrew Nicolson, John Morrissey and David Wilcox.

2001 EUREKA PRIZES

Roger Muller, Australian Museum, 6 College Street, Sydney NSW 2000
Toss Gascoigne, Federation of Australian Scientific and Technological Societies, PO Box 218, Deakin West ACT 2600

The Australian Museum is proud to announce the launch of the 2001 Eureka Prizes - Australia's pre-eminent national science awards. The 2001 series is the biggest ever, with three new prizes – for biodiversity research (sponsored by the Royal Botanic Gardens Sydney), for a science book (sponsored by Reed New Holland) and for earth, environmental and planetary sciences in secondary schools (sponsored by Macquarie University). Other Prizes cover environmental and scientific research and journalism, environmental education programs, industry commitment to science, critical thinking, engineering innovation, secondary school biological sciences and promotion of science.

With a record thirteen prizes on offer worth over $120,000, the Eureka Prizes are now the most comprehensive science awards in Australia. They are a unique cooperative partnership between the federal government, the NSW state government, educational institutions and a range of private sector organisations and companies designed to raise the profile of science in the community.

The vitality of the Prizes relies on the efforts of people and organisations across Australia in identifying suitable candidates for these prestigious awards. Your help in both promoting the Prizes, and in entering/nominating candidates, will ensure that the Eureka Prizes continue to highlight Australia's outstanding scientific and technological achievements.

Entries/nominations close on Friday 9 February 2001, with the winners announced at an award ceremony at the Australian Museum on 15 May 2001 and profiled on Quantum, ABC TV's award-winning national science program, on 17 May 2001. Further details and entry forms on all Prizes are available from the Australian Museum's webpage at www.austmus.gov.au/eureka or from 02 9320 6230.

DESERT TECHNOLOGY VI INTERNATIONAL CONFERENCE

September 16-24, 2001, Urumqi, China
First Announcement

Conference Themes

The major theme of this conference will be *Ecological Construction, Environmental Protection and Regional Development in Arid Land.*

Major topics for discussion will be:

- Cause and controlling technologies of desertification and salinisation-alkalisation;
- Restoration and rehabilitation of deteriorated ecosystems;
- Reasonable utilisation of biological resources and the protection of biodiversity;
- Oasis agriculture and its sustainable development;
- Reasonable development and utilisation of water resources;
- Mechanisms of sand-dust outbreak and counter-measurements for monitoring and control;
- Construction of great engineering (highways, railways, water conservancy) and new technologies for environment protection.

Calls for Papers

Participants are invited to submit a one page abstract with an application form to the conference secretariat before January 31, 2001. The abstract (in English) should be limited to between 200~300 words and submitted electronically or typed on A4 paper and sent by mail. The conference secretariat will send out the second announcement notice before the end of February 2001 to those who have submitted an application form. All accepted abstracts would be complied into a conference proceedings for participants. Those chosen to speak at the conference will have their papers published in a special edition of *The Journal of Arid Land Studies* (Japan).

Conference Fees

Registration fees will be US$300 (including information and mid-conference field trip). Accommodation will cost from $50 per person per day (twin share) to $80 per person per day (single) in a four star hotel room.

For further information please contact:

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THESIS ABSTRACT

A study of degradation processes at patch to landscape scale within the arid shrubland of WA.

Alec Holm, Alexander Holm and Associates, 26 Edward St, Nedlands WA 6009

The following is the abstract from my recently submitted PhD thesis. The work has been broken down into five papers and submitted for publication. It was supported through a research fellowship from Meat and Livestock Australia. ARS provided a travel fellowship which assisted me in a grand tour of several 'rangeland' universities in the USA.

The arid shrubland of Western Australia is a landscape that may be characterised at one scale as a patch-mosaic. Vegetated patches, either shrubs (low-shrubland) or groves of low trees and undershrubs (low-woodland) separate inter-patch areas where annual or herbaceous species grow in favourable seasons. The nutrient-enriched patches moderate both aeolian and fluvial geomorphic processes to retain water and nutrients within the landscape. Destruction of these patches, through perturbation such as excessive grazing, may be the start of a degradation process, but it has been suggested that any loss of patches may have different outcomes for productivity according to the 'resilience' of landscapes.

The study objectives were to:

- seek evidence for a general model of landscape function whereby non-degraded, 'functional' landscapes are more efficient in converting rainfall into plant mass than 'dysfunctional', degraded landscapes;
- characterise responses in primary and secondary productivity to perturbation on a resilient landscape and seek evidence for alternative models to the general model of landscape function based on the concept of resilience;
- evaluate nominal and empirical indicators of landscape function at the scale of patch-mosaics; and
- test whether rainfall-use efficiency, as an integrating indicator of landscape function, provides a common link between hierarchies of spatial scales from patches to regions.

Two major data sets were used in this thesis. Data were collected at the end of winter in 1998 and 1999 from within four sampling domains (each about 1000 km^2) in the Murchison (~27º S; 116º E) and north-eastern Goldfields (~29º S; 121º E) regions that have been variously perturbed by livestock grazing. Data from long-term studies (1983 to 1994) of a chenopod shrubland resilient to perturbation (Boolathana Station 24º 39• S; 113º 42• E) were also examined in light of the above objectives.

A general relationship was demonstrated between landscape function and primary productivity. There was less phytomass on degraded than on non-degraded landscapes. Relationships were stronger at broader spatial scales of patch-mosaics than individual patches. In the long-term study, the variability of biomass responses to rainfall increased on the degraded landscape. In years with greater rainfall, there was also more phytomass, mostly from herbaceous species. The potential for secondary productivity, assessed using grazing sheep, was reduced on the degraded site, however average productivity at recommended rates of stocking was similar on a landscape where shrubs were either abundant or scarce.

At the scale of patch-mosaics, the area occupied by patches vegetated with shrubs, trees or groves of trees and shrubs in comparison with the inter-patch area, was confirmed as a useful standard against which to assess landscape function in this environment. Alternative nominal indicators of stability, infiltration and nutrient cycling provided little additional information.

In the absence of any known procedures, landscape types were nominally classed as resilient or non-resilient on evidence of soil erosion. Based on this classification, landscape resilience provided few insights into the capacity of landscapes to respond to rainfall when assessed at scales from patches (~m^2) to patch-mosaics (~hectares) and much broader scales (~1000 km^2). Contrary to expectations, herb mass increased on both resilient and non-resilient landscapes as the proportional area occupied by vegetated patches declined.

Rainfall-use efficiency was generally greater on non-degraded landscapes and the strength of the relationship was much stronger at broader scales of patch-mosaics than at patch-scales. At landscape-scales, comparisons of trends in rainfall-use efficiency over nearly a decade, derived from remotely sensed data (I-NDVI), revealed landscape-scale differences between sites strongly indicative of degradation. Relationships between landscape degradation and rainfall-use efficiency were temporally variable, making predictions in any one year problematic but rainfall-use efficiency is likely to be a potent indicator of landscape degradation (or recovery) over decadal time scales and at spatial scales from thousands of hectares to thousands of square kilometres.

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The Australian Rangeland Society

REPORTS FROM THE 2000 ANNUAL GENERAL MEETING

ACN 008 784 414

(Ed. The following financial reports were not available when the July newsletter went to print. They have been included in this issue for completeness.)

THE AUSTRALIAN RANGELAND SOCIETY
ACN 008 784 414
STATEMENT OF PROFIT AND LOSS
FOR THE YEAR ENDED 31 DECEMBER 1999

1998		
	INCOME	
28074	Subscriptions	26985
3200	Interest – NAB, Orange	3526
9	Interest – WBC, Adelaide	6
133	Interest – Bank SA, Port Augusta	-
1	Interest – CBA, Cobar	-
(20756)	Net profit/(loss) Journal	(13370)
(7877)	Net profit/(loss) Newsletter	(5007)
(897)	Net profit/(loss) Conferences	(607)
1887		11533
	EXPENSES	
3962	Accountancy and audit	3778
115	AGM expenses	883
495	Bank charges	853
2116	Depreciation	1687
95	Filing fees	130
13428	Honoraria	7687
-	Insurance	90
562	Printing, stationery and postage	1670
-	Scholarships and grants	4730
1378	Subscriptions and donations	1478
-	Travel and accommodation	685
22151		23671
($20264)	NET LOSS FOR THE YEAR	($12138)

THE AUSTRALIAN RANGELAND SOCIETY
ACN 008 784 414
BALANCE SHEET AT 31 DECEMBER 1999

	SHARE CAPITAL AND RESERVES		
100829	Retained profits		88691
100829			88691
	Represented by:		
	FIXED ASSETS		
4218	Plant and equipment (at tax value)		
	CURRENT ASSETS		
15963	Trading account – NAB, Orange	3180	
4277	Trading account – BWA, Journal	5389	
537	Trading account – WBC, Newsletter	2031	
1185	Trading account – CBA, Cobar	944	
1359	Trading account – ANZ, Victoria Park	1182	
3558	Trading account – WBC, Adelaide	3413	
239	Funds in transit	-	
27118			16139
	INVESTMENTS		
80778	Term deposits – NAB, Orange		81242
112114	TOTAL ASSETS		99912
	CURRENT LIABILITIES		
11285	Trade creditors		11221
100829	NET ASSETS		88691