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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Range management Newsletter

No. 99/1 April 1999

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

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EDITOR (RMN)
Gary Bastin
CSIRO, PO Box 2111, Alice Springs NT 0871
Phone: 08 8950 0137 Fax: 08 8952 9587
Email: Gary.Bastin@dwe.csiro.au

EDITOR (Rangeland Journal)
Dr Allan Wilson
"Cal Col"
Deniliquin, NSW 2710
Phone and Fax: 02 5882 3338
Email: adwilson@deni.net.au

PRESIDENT
Peter Johnston
Sheep and Wool Institute
Queensland Department of Primary Industries
Locked Mail Bag 4
Moorooka QLD 4105
Phone: 07 3362 9577, Fax: 07 3362 9429
E-mail: johnstpw@dpi.qld.gov.au

VICE PRESIDENT
Fleur Tiver
School of Environmental Management
The University of SA
The Levels SA 5095
Phone: 08 8302 5137; Fax: 08 8302 5082
Email: fleur.tiver@unisa.edu.au

IMMEDIATE PAST PRESIDENT
Ron Hacker
NSW Agriculture
Trangie Agricultural Research Centre
PMB 19
Trangie NSW 2823
Phone: 02 6888 7404, Fax: 02 6888 7201
E-mail: ron.hacker@smtpgwy.agric.nsw.gov.au

SECRETARY
Eda Addicott
Queensland Herbarium
PO Box 1054
Mareeba QLD 4880
Phone: 07 4092 8526, Fax: 07 4092 3593
E-mail: Addicoe@dpi.qld.gov.au

TREASURER
Manda Page
Department of Natural & Rural Systems Management
University of Queensland
Gatton College QLD 4345
Phone: 07 5460 1182, Fax: 07 5460 1324
E-mail: mpage@jedi.uqg.uq.edu.au Manda Page

SUBSCRIPTION SECRETARY
Bruce Alchin
Department of Natural & Rural Systems Management
University of Queensland
Gatton College QLD 4345
Phone: 07 5460 1182, Fax: 07 5460 1324
E-mail: b.alchin@mailbox.uq.edu.au

SUBSCRIPTION MANAGER
Rob Richards
Department of Land and Water Conservation
PO Box 77
Condobolin NSW 2877
Phone: 02 6895 2033, Fax: 02 6895 3406
E-mail: dlwcondo@lisp.com.au

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FROM THE EDITOR

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

Welcome to the first newsletter for 1999; a big year for the Society and rangelands in general, with the VI IRC in Townsville in July. This issue has an update from the IRC management on organisational matters associated with this big event as well as news on Council's preparations for the IRC plus other matters.

First up though, there are two major articles dealing with aspects of soil and vegetation recovery following different forms of disturbance. In the first article, Tim Fatchen and John Woodburn report on their work to develop criteria for the successful abandonment of seismic lines in the Cooper Basin of South Australia. The authors define "abandonment" as "the point at which exploration impacts are ameliorated, rehabilitated or otherwise recovered sufficiently for the regulators (SA Government) to release the explorers from further responsibility for management or rehabilitation". In developing suitable criteria, Tim and John sought objective and simple measurements that had predictive capability. They found that in order to apply these criteria, the existing landscape stratification (usually land system mapping) was deficient and they had to develop their own "functional" land unit descriptions. The authors suggest that this approach could usefully be adapted to better understand the impact of other forms of land use. Finally, Tim and John encapsulate their major findings in terms of two vexed issues: supposed soil compaction associated with seismic lines, and the commonly held view that sand dunes are resilient and the original vegetation can rapidly re-establish following abandonment of seismic lines. Read their article to find Tim and John's answers to these issues.

In the second article, Ali Valamanesh provides insights into the selection of exclosure sites, and their management, for the study of vegetation dynamics under grazing. Ali uses a state and transition model to describe how vegetation can degrade through excessive grazing, and recover with resting or exclosure. Vegetation change is often slow and unpredictable, particularly in the arid rangelands. Thus if exclosures are to be used to better understand the processes, and particularly demonstrate that recovery can occur, suitable sites should be carefully selected so that allocated resources of manpower and money are used to best advantage. Ali provides some valuable pointers on how to maximise the benefits to be gained from exclosures.

Other articles in this newsletter report on recent meetings and other activities in the rangelands. I am sure you will find something of interest in this issue. I need to produce the next newsletter before the IRC and need your help to fill it. Please send me your news and views by mid June.

DEVELOPING CRITERIA FOR ABANDONMENT OF SEISMIC LINES

Tim Fatchen, Fatchen Environmental, PO Box 462, Mt Barker SA 5251
John Woodburn, Woodburn Associates, 429 Gilles St, Adelaide SA 5000

In SA, gas and petroleum exploration activities in the Cooper Basin are governed by the Petroleum Act and carried out under Codes of Practice (Santos, 1991a&b; both currently under review). The Codes have been predominantly prescriptive ("do this"), with some objective rules ("achieve this outcome"), supplemented by operational manuals. The basic intent of the environmental regulation and management is the eventual return of the affected area to a reasonable approximation of the ecosystem it is in. Prescriptive approaches increasingly are perceived as not always leading to this outcome.

The SA Government regulator, Primary Industries and Resources SA (PIRSA, incorporating the former Mines and Energy SA) is gradually moving from prescriptive regulation towards objective regulation of exploration activities. As part of this process, criteria for abandonment of seismic lines and exploration wellsites are being developed, through a series of independent studies (Moss and Low, 1996; Fatchen and Woodburn, 1997; Woodburn and Fatchen, 1998).

"Abandonment", also termed "completion", is the point at which exploration impacts have been ameliorated, rehabilitated or otherwise recovered sufficiently for the regulators to release the explorers from further responsibility for management or rehabilitation. Some residual impact is inevitable, since even with the most carefully prepared or rehabilitated site, there will still persist alterations in soil surface characteristics, in soil structure and chemistry, in soil water relations, and in the pattern of re-invading organisms. Criteria for abandonment would therefore be applied before total recovery is complete, and hence must have a *reliably* predictive component.

The proposed criteria for seismic line abandonment derived from the studies at present are:

- Terrain returned to its original form, or to a reasonable resemblance of it.
- Soil surfaces restored to their original state, or a reasonable resemblance of it.
- Plant species local to the area able to re-colonise.
- Linear obtrusiveness limited by visual obstruction.

In the following, we briefly look at part of what is needed for criteria to work reasonably, and at two vexed issues, soil compaction and resilience of dunes, which arose in the mix of review and field investigation. *None* of the following is any sort of audit or judgement of present exploration practices, nor is it necessarily the view of PIRSA. Seismic lines of varying ages and quality of recovery were examined in field work to document outcomes of procedures and the processes leading

to those outcomes, whether under present or past seismic line development techniques.

What is Needed in Determining Criteria?

Predictive capability

Given an arid climate, at least some of the criteria have to deal with future regeneration at a point where the regeneration process is only beginning. This led us to concentrate on *physical* aspects of site completion, with biological aspects secondary. Hence the first two criteria, above. The lasting effects of the construction of lines are a function of soil and landform mechanics first, and of biological processes a long way second.

Physical aspects are measurable at an early stage, allowing predictions to be made of future behaviour of the site, and a reasonable evaluation given of the likelihood of future re-establishment of at least the local plant community. The alternative criterion of using initial invasions of sites by opportunistic species is at best an unsafe guide to the development of future communities.

Soil requirements of plant species in the area are reasonably well known. Much of the knowledge derives from various studies into arid-zone soil-plant relationships from the mid-1920's through to the 1960's (Lange and Fatchen, 1990), with occasional direct plant/soil relationship studies since (e.g. Buckley, 1982). Few of the major studies (e.g. Jessup, 1951) extended into the Cooper region, but many of the species, and their soil relationships, do. As well, subsequent studies provide a great deal of correlation between species, communities and their physical environment (e.g. Gillen and Reid, 1988).

Most of these studies dealt with what now may seem very unexciting matters, and possibly the lack of direct reference to them in current mainstream literature stems from their unexciting nature. However, from them, one can be fairly sure of the basic soil requirements without which particular species and communities *cannot* grow or develop, regardless of whatever other factors, including climate, are in play. At the simplest, where significant changes result from exploration activities — for example, alterations to microtopography, to soil water storage capabilities, in re-ordering of soil profiles, or importation of soils — the long-term outcome cannot be a near-equivalent of the pre-existing system. It follows that physical characteristics, post-exploration activity, are a major predictor of the eventual outcome. These characteristics can be determined with simple and immediate reference to pre-exploration conditions prevailing alongside areas of possible impact.

Whether or not plant species can actually get back onto a seismic line or drill pad, unaided, is a significant but subordinate consideration. One of the limits to predicting future vegetation from present physical characteristics is the lack of information on the dispersal mechanisms, abilities and rates of most of the species. For example, *Triodia basedowii* (spinifex) in the areas studied was only infrequently found to have re-established on seismic lines, at least within the time-frames observed during the study. On graded lines (Figure 1), the microtopographic changes may well prevent it from reaching the line, and changed soil conditions may prevent its establishment if it does (Figure 2). The *Dodonaea viscosa* (hopbush) visible in Figure 1, on the other hand, can easily disperse onto the line and the changed soil conditions may well favour its establishment.

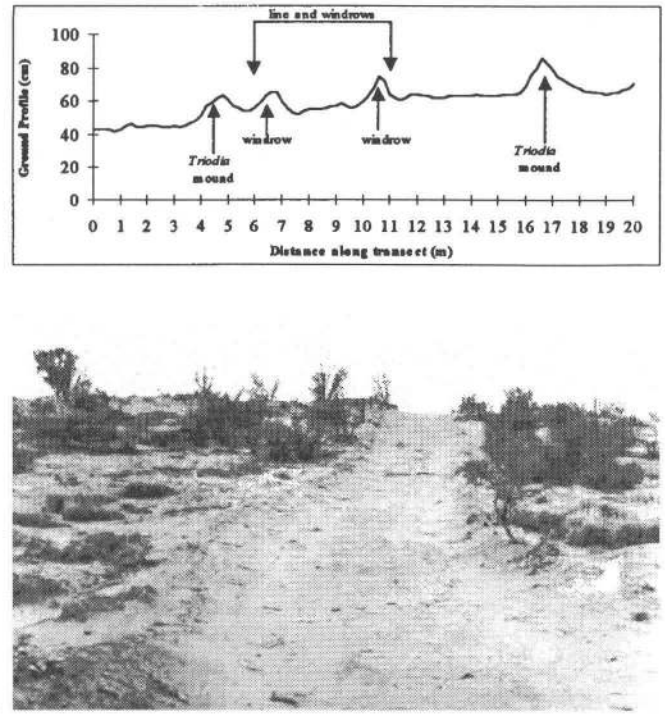


Figure 1. 1997 graded line at dune crossing with Dodonaea viscosa *and* Triodia basedowii *vegetation.*

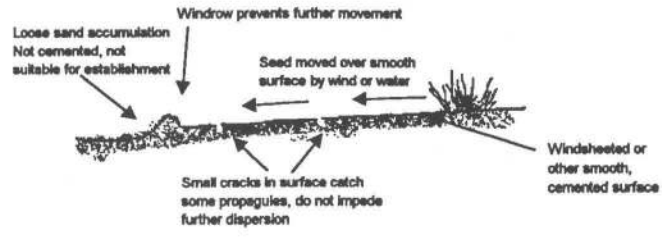
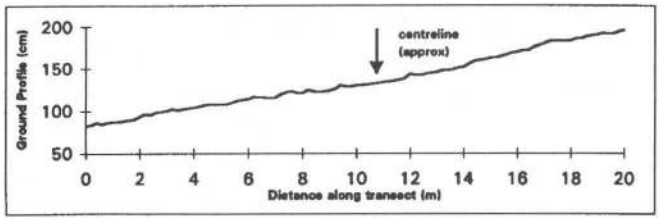


Figure 2. Microtopography and soil surface changes affecting Triodia basedowii *dispersal and regeneration.*

We found the simplest physical characteristic, whether the pad or line can be seen or not, to be one of the more important indicators. All aesthetic impacts aside, the remaining visibility itself directly indicates the level of continuing residual impacts (Figures 1, 3, 4).



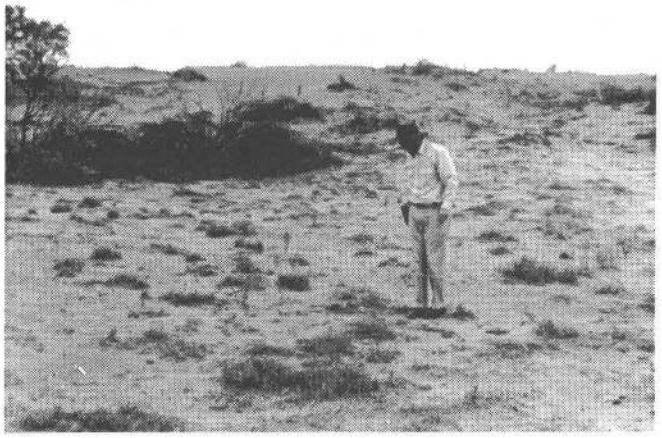


Figure 3. 1994 line at dune crossing, no grading or blading. The photo is on the line midpoint and the microtopographic transect crosses the photo in the foreground.

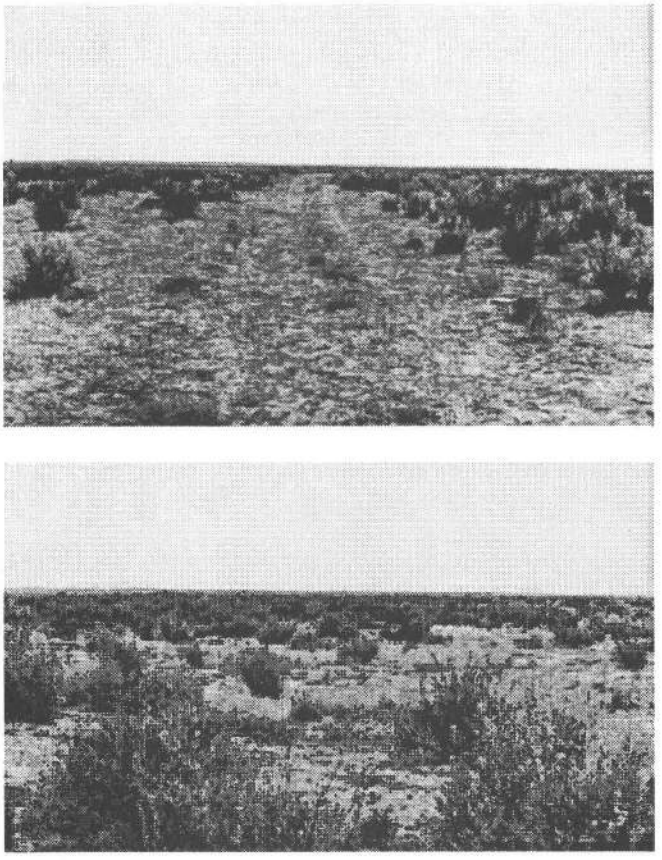


Figure 4. 1983 (top) and 1992 (bottom) seismic lines in Atriplex nummularia *on heavy clays of a floodplain. No* A. nummularia *has established on the graded 1983 line in 14 years. The 1992 "line" weaved through the shrubland: the photo looks along its mean path.*

Objective and simple measurement

Criteria have to be assessable, with observer opinion minimised; cost-effective; and defensible through all stages of possible regulatory actions, from co-operation and persuasion at one end to the extreme of cancelling the exploration license at the other. All requirements need measurement in one form or another, either as a clear *yes* or *no*; or as an objective measurement of a relevant parameter, set in a range of acceptability/non-acceptability criteria. All also require simplicity in measurement, either by direct field evaluation or by a limited and routine laboratory evaluation. Hence terrain, soil characteristics and vegetation parameters are favoured, while intricate geochemistry or organisms requiring a high taxonomic skill level and extended laboratory work are not.

One can arrive logically at the parameters most likely to succeed. Individual processes of disturbance have an immediate impact which in turn has specific consequences. The measurable parameters used are associated with these impact consequences. The apparent plethora of potentially measurable parameters can be reduced to two relatively small sets of biological and physical parameters, covering the full range of major impacts:

Biological	**Physical**
Plant biomass	Slope
Plant cover (projective)	Microtopography/surface
height, structural class	roughness
Plant density	Soil grain size/texture
Major plant species	(surface and profile)
Indicator plant species	Bulk density (surface and
Litter	profile)
	Dispersibility
	Simple chemistry
	(P/N/K, pH)

For example, removal of plant cover may come about through blading, grading, rolling, cutting and vehicle use. Impact consequences include visual changes, reduced density / cover / diversity, reduced protection against wind and water erosion, reduced infiltration rates, reduced splash protection and so on. Basic parameters of biomass, cover, density, height, and species composition all provide an index of the extent of these impacts. Similarly, removal of surface soils, including stone cover, can occur through shallow grading, line cutting (especially in dune crossings), removal of upper soil horizons, and general vehicle use. Consequences include visual impact; reduced protection against erosion; altered infiltration, percolation and runoff rates; reduced splash cover; increased soil dispersion; nutrient loss; and hardpan exposure. Basic parameters of slope, texture, bulk density, simple nutrient chemistry and descriptors of microtopography effectively cover this range.

Visibility of the line itself is a useful index of recovery. The studies have demonstrated that seismic lines can be, and have been, prepared in all types of terrain in such a manner that there is no more than short term residual impact (Figures 3 and 4). Lines become almost invisible on the ground where the soil surface has not been cut, microtopography shows no substantial change other than the occasional wheelmark, ephemeral cover

is identical on and off line, and perennial vegetation has been dodged, not bladed.

Criteria in context of functional land units, not systems

The cut-off for achievement or non-achievement of criteria is affected by the characteristics of land units. Application of criteria can be less stringent in land units with a demonstrable self-repair capability than in units with little or no self-repair capability. The context must, however, be set within a land unit framework. Approaches based on broad landscape categories, and particularly the land system emphasised in regional description and strategic planning, will result in criteria or tests of criteria too generalised to be readily applied, and not easily defensible in objective regulation. Dunefield land systems are the obvious example, with major contrasts in soil, water relations, erosion processes, and vegetation between the land system's constituent swale and sandridge units. As a corollary, *functional* land unit description and definition is necessary, otherwise the level of detail and intricate local variations become overwhelming. Again, a process of simplification is needed.

Our unit characterisation and identification initially derived from a simplification of the physical terrain units derived by Grant (e.g. Grant, 1970). The steps in simplification were an initial lumping of equivalent or similar terrain units within the various land systems, followed by iterations of field investigation, review and further simplification. The outcome was a relatively small and readily identifiable group of functional units related to the processes, impacts and responses to exploration (Table 1).

The functional classification, a hybrid of terrain units and ecological characteristics, looks odd without a full documentation of its derivation. Its utility, and its apparent oddity, lies in its applicability to the particular processes and impacts of exploration in the region. The extreme example is the classification of gibber country into only two units, of respectively less or more than 1° (2%) slope. Above 2% slope, removal or disruption of gibbers initiates accelerated erosion which, on the field evidence, proceeds indefinitely. It will be much faster on a 10% than on a 3% slope, but the long-term outcome will be the same: the residual impacts will continue and worsen. From the point of view of criteria for abandonment in gibber country, predictions of long-term responses simply depend on whether one is dealing with flat or sloping ground.

Despite the simplicity, individual components of the classification can be related back to the detailed terrain descriptions for assessing physical characteristics.

The functional classification is quite inappropriate for application to unrelated activities such as pastoral use, or tourism management. We would suggest, however, that less emphasis on general (systems) descriptions and more on determining functional units could lead to a more relevant and relatively simply understood context for other land uses also.

Two Unconventional Findings

Compaction and ripping

Compaction has conventionally been seen as a major problem inhibiting rehabilitation, with mechanical treatment needed to assist recovery (e.g. in National Parks and Wildlife Service, 1984; Graetz and Pech, 1982; Stoll, 1989). It was the first major impact relating to soil properties highlighted by Moss and Low (1996) in the present studies. In the petroleum and mineral exploration industry generally, reducing compaction is often cited as one of the purposes in ripping temporary tracks and drill pads to aid regeneration. Until actually tested in the field, the degree of soil compaction was considered likely to be one of the primary criteria.

Accordingly, we undertook extended soil density measurements on and off seismic lines, at each of 23 sites in floodplain and dunefield areas. A Dynamic Cone Penetrometer was used, with readings typically to depths of about 80-100 cm. In the majority of cases, soils under seismic lines showed either no change from soils immediately adjacent to lines, or *loosening*, the latter most commonly on sands and clayey sands. Compaction was recorded in less than a quarter of observations, again most commonly on sands and clayey sands. Clays of floodplain areas generally showed no change, results often being influenced by presence or absence of cracking and fissuring of the surface soils.

That seismic activity, contrary to appearances, may decrease soil density is indicated by trials aimed at establishing the impact of the use of Leopard tanks in manoeuvres in the Woomera district (Braunack, 1985). These trials had elements in common with seismic operation: an initially unprepared surface, movement of a vehicle at a variety of speeds and patterns, and relatively few vehicle passes when compared with vehicle traffic on a constructed road. In the trials, vehicle movement resulted in shearing of soil structure and a consequent lowering of density and reduction in soil strength. This phenomenon of de-compacting, particularly of the profile immediately below the surface, has tended to be overlooked in the concerns with seismic activity, with broader off-road vehicle use issues, and with petroleum and mineral exploration generally. For compaction to occur, the soil moisture content must lie within a narrow range. Arid zone soils are generally drier than optimum, with only a short "window" existing after prolonged rains.

Ripping as a rehabilitation technique is usually not applied to seismic lines in the Cooper Basin. However, it is applied to drill pads. Drill pads also were found not to be compacted other than at the extreme surface, and often not there either. Deep ripping (e.g. 60 cm rips) in these circumstances is not justifiable on the grounds of reducing compaction alone.

Table 1. Simplification of land classification as context for criteria.

Major land system	Main components	Subdivisions	Outline of reasons for division
Dunefield (D)	ridge	clay plinth (generally, yellow sands)	Low self-repair capacity because of absence of loose sand, potential for permanent gully erosion because of clay plinths. Cuts will not self-repair and perennial vegetation will not establish.
		deep sand (generally, red sands)	High self-repair capacity because of moving sand. Cuts will self-repair. Re-establishment of perennial vegetation may take >30 years.
	swale	sandy swale (surface movement)	Moderate self-repair capability because of loose sand, provided lines have not been cut and no clay windrows formed.
		clayey sands (little surface movement)	Low self-repair capability because of absence of loose sands, but artificial scalds can mimic natural scalds.
		clay swale (no surface movement)	Permanent visual impacts where water is collected and perennial vegetation establishes in depressed or rutted line. Even slight windrows visible after many years.
Gibber and Tableland (G, T)	flat (<2% slope)		
	sloping (>2% slope)		Accelerated and permanently continuing erosion will occur if gibbers are removed on slopes >2%. Whatever the actual slope >2%, erosion will be inevitable and uncontrollable. Greater slopes will increase the rate of accelerated erosion but not the fact of erosion and long-term outcomes will be equivalent.
Floodplain (F)	stream crossings		Specific problems associated with channel blocking or ramps pushed into channels; visual impacts associated with tree removal.
	terraces and levees		Visual impacts associated with tree removal.
	swamps and flats	perennial vegetation woodland, shrubland, tall-grass, hummock-grass formations	In all cases, visual obstruction of lines is necessary, otherwise the line will remain obvious in the long term due to the absence of the perennial species along the line. Visual impacts remain pronounced whether the perennials are trees or dwarf shrubs.
		ephemeral / *Sclerolaena* spp	Lines not obvious unless cut.

Limits to dunefield resilience

The conventional view of dunefields is of a highly resilient system, with almost immediate recolonisation of disturbed areas by ephemeral species, rapid infill of cuts, and relatively rapid re-invasion of major perennials. While there is little doubt that dunefields are resilient, accepted time-scales for unaided recovery appear to be somewhat optimistic.

Within dunefields of the region, the best estimates for the period of recovery of *graded* seismic lines to a state visually and biologically similar to their surrounds are in, or derived from, Alexander (1981) and Buckley (1980, 1981, 1984). Alexander (1981) found little-used lines in the Simpson Desert, constructed by the French Petroleum Co. 1963-1966, had reached an approximation of their surrounds within 13 years, and some within 7-10 years. Buckley (1980) suggested a span of 3-10 years for establishment of perennials, and 30 years for a return to original floristic composition; given effective rains immediately after abandonment (an unlikely event).

Social and Ecological Assessment (1987) estimated recovery time on seismic lines within the Cooper Basin, based on a return to a cover similar, but not necessarily identical, to the surrounds. They also estimated recovery on dune ridges to be 10-20 years, and on dune flanks to be 15-20 years for lightly bladed lines or over 20 years for windrows to disappear.

It is worth noting that most of the research cited, and much of the derivative management studies based on it, are affected by the extreme 1973-1974 rainfall events.

The tendency of interpreters of this information, not excepting the present authors (e.g. in Lange and Fatchen, 1990; Marree Soil Conservation Board, 1997; National Parks and Wildlife, 1984) has been to take the 30 years as an upper limit and assume the median time to be somewhere within the 10-20 year range. Unfortunately, the data from our studies suggest that rapid infill of cuts and relatively rapid re-establishment of perennials are the exception rather than the rule, at least in the Cooper Basin.

Deep-cut lines in dunes with clay plinths and relatively stable crests (Table 1) do not infill over any time scale we could examine (Figure 5). Even in dunes with little clay content and relatively unstable crests, cuts are still evident up to the 16-year limit to lines we could identify. Vegetation recovery is variable: most dune ephemerals appear to establish rapidly, but the dune perennials *Zygochloa paradoxa* and *Triodia basedowii* were only occasionally found colonising old cut lines during the study.

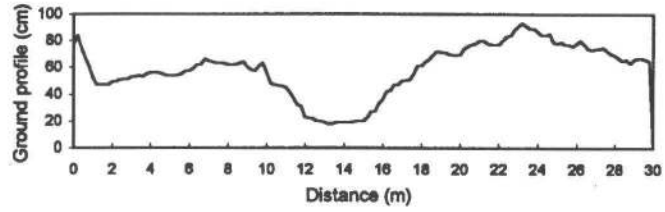


Figure 5. Ground surface across 1982 cut line in dune crest, as at late 1996, with cut still not infilled.

Mechanisms limiting *Triodia* colonisation were suggested above. For *Zygochloa,* there are no obvious surface condition requirements: we suggest that its failure to colonise many lines in the long term may be at least in part a consequence of lower soil water storage capabilities associated with the loosening of sand profiles under seismic lines. It would appear that the accepted time-scales for unaided recovery in dunefields are somewhat optimistic. The alternative, to actively regenerate cuts, raises further issues of soil density and texture changes, the effects of which are unknown. The need to avoid cuts wherever possible (as in Figure 3) is obvious. The applicability of the proposed criteria is also obvious.

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EXCLOSURES AS A TOOL IN STUDIES OF RANGELAND VEGETATION DYNAMICS

Ali Valamanesh, Green Environmental Consultants, 5 Admella Court, Hallet Cove SA 5158

Introduction

In the Australian rangelands, the mode of grazing has changed since the arrival of Europeans. Sheep, cattle, rabbits, goats, donkeys, camels and other feral animals have replaced many smaller mammals while kangaroo populations have increased. The overall deleterious impact of overgrazing on the vegetation is well known. However, our knowledge about the details of grazing behaviour of herbivorous animals and the response of different plant species to grazing, which can vary under different ecological conditions, is very limited. Exclosures have been used for plant population studies for a long time. The T.G.B. Osborn vegetation reserve on Koonamore station in South Australia is one of the world's oldest exclosures. This reserve has provided valuable records about the regeneration and population dynamics of different Australian arid-zone plant species. These records have been the subject of many postgraduate investigations and scientific articles.

One of the deficiencies of the T.G.B. Osborn reserve is the limited number of parallel monitoring sites outside the reserve that can provide comprehensive information about vegetation dynamics under both grazed and ungrazed conditions.

The South Australian Government has established exclosures to address the above-mentioned need. I studied those exclosures and their reciprocal open plots (control) as a part of my study on the issue of "Reference Areas for Rangeland Monitoring and Assessment". Records from these study sites have revealed issues about the better design and use of exclosures that I believe are worth raising with rangeland specialists and managers.

On the Use of Exclosures in Vegetation Studies

When planning an exclosure program, there should be a clear definition of the purpose of the study and the questions that are to be answered by establishing exclosures. These answers determine all aspects of their design and monitoring. Obviously, since the questions can be quite different, it is not possible to provide a single recipe for all exclosure studies. However, some general considerations can be summarised as follows.

Site selection and role of the state of vegetation

My studies of South Australian exclosures revealed that grazing exclusion does not necessarily lead to increased vegetation or improved range condition. To illustrate this, I use the figure below which is based on the concept of "thresholds" (Friedel, 1991) and the "state and transition" model of vegetation dynamics in Australian rangelands (Westoby *et al*, 1989). For clarity in developing my argument,

the possibility of multiple transitional and stable states was ignored. Using this model, I will explain how the condition of the vegetation can determine the results of grazing exclusion.

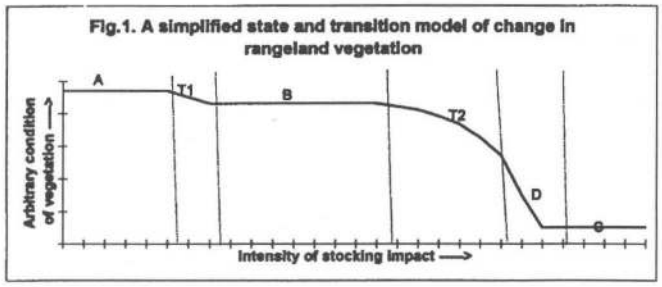

Fig.1. A simplified state and transition model of change in rangeland vegetation

According to the model above, state A is the stable state where grazing has no detectable role in developing or maintaining the state of the vegetation. Hence, exclosures should not cause any difference in the dynamics of the vegetation. Here, stability is defined as "the ability of the vegetation to sustain its diversity and plant populations at viable densities under the combined impact of grazing and climate". It should be emphasised that the definition of stability and its magnitude is a relative term and it can differ with change in the scale of time and space.

State T1 is a transitional state where, because of grazing pressure, the vigour and/or density(ies) of certain species are changing (usually declining). During this process, the highly desirable and/or grazing intolerant species may become locally extinct. Under certain grazing intensities, the process of change may stop at the next stable state, B. Here, a new balance exists between the vegetation and grazing system. The vegetation at the transitional state T1, if exclosed from grazing, can change in the opposite direction towards the stable state A.

Under certain grazing intensities, the transitional stage T1 may pass a threshold and reach the stable state B. This stable state can be:

- Quasi-stable where the new vegetation structure is maintained by current stocking pressure. Large changes in grazing intensity, including its exclusion, can change the vegetation to a different state.
- Truly stable where the vegetation will withstand the current grazing pressure and remain unchanged regardless of the presence or absence of grazing.

It is obvious that further increasing grazing intensity, or moving closer to the watering point if a piosphere has developed, will cause the vegetation to again become unstable and start to decline. This is the beginning of the transitional state T2. Removal of grazing (exclosure) during this transitional state can return the vegetation to state B but it is unlikely to recover further. During the decline to the transitional state T2, another threshold may be reached beyond which the vegetation cannot return to its previous state (B).

It should be emphasised that every threshold does not necessarily result in a new stable state. Loss of topsoil and/or the seed reserve, or increase in woody weeds, can produce retrogressive change in the vegetation which grazing, or its exclusion, may have no effect on. This stage, defined as 'degradational' (D), although a transitional one, will move in one direction only. The stable state C in the model is the further degraded stable state where its recovery requires direct ameliorative action.

The key factor in the outcome of grazing exclosure is the *current role of grazing* in the present condition of vegetation and its dynamics. Areas in the transitional stages should show a definite response to exclosure in a relatively short time, while areas in a stable state or undergoing a self perpetuating degradational transition may not appreciably improve even with long term exclosure.

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It should be stressed that the above classification is a highly simplified picture of the processes that occur in the rangelands. It is quite possible that within the assemblage of many different species, the populations of some are in a stable state while others are in transition. A different state and transition model may apply for every species.

Visibility

Accessibility is important when choosing a study site. Seeking the assistance of local land managers to report any changes in the vegetation is more effective when exclosures are visible along their regular route. It is very important that events like fire or flood are reported.

Size of exclosure, experimental plots and recording of observations

The generally recommended minimum size for exclosures is one hectare. However, exclosures of almost every size have been employed. Exclosure size will be mainly determined by the purpose of the study and the abundance and distribution pattern of plant species of interest. A 50 x 50 m exclosure may be sufficient for perennial grasses and bushes but will certainly be too small for larger shrubs and woody perennials because only a few plants will be exclosed. When studying the grazing impact on a single, sparsely scattered species, it may be more practical to protect individual plants rather than set up large exclosures.

Time scale and associated issues

Major change in the vegetation of arid and semi-arid environments generally, and in Australia especially, is usually a very slow process. Also, stochastic events such as high rainfall or fire which drive these changes are rare and unpredictable. This means that long term monitoring of exclosures is necessary. Planning should allow for the long term availability of both finance and personnel. The more or less persistent grazing pressure of domestic stock and other herbivores requires regular visits to study sites for data collection while stochastic events necessitate the flexibility for opportunistic visits. The frequency of regular visits should be at least once a year and preferably timed so that the seedlings of perennial species can be recorded as early as possible after their recruitment. Thus, where there is an expectation of an annual wet period, visits might be made

shortly after this time. However, the impact of stochastic events like high rainfall, fire, flood, drought and population explosions of rodents or insects needs close monitoring also, and this requires that additional "opportunistic" surveys are made after such events. These data will provide significant information that regular annual records cannot provide.

Exclosure studies usually need labour-intensive recordings of the precise location and other attributes of every individual perennial plant. The amount of time assigned for travel to the study sites and data collection should therefore be sufficient to allow personnel to carry out their duties without undue haste. Allowing adequate time for travel and carrying out of the surveys is especially important when the study sites are located in remote areas and fatigue from travelling, especially when combined with unfavourable weather, can affect the quality of the information collected.

The design of, and materials used to build, exclosures should also be such that they persist for many decades with minimal need for maintenance.

Presence of wild and feral animals and the issue of their "actual densities"

The populations of wild, feral and even domestic animals can be quite variable within the study site due to climate and other factors. The grazing impact of herbivores on a study site will depend on both the overall population density of herbivores and the composition of the vegetation at the site compared with the larger area, i.e. the vegetation may be more or less attractive for one or more of the main herbivores in the area. Patch grazing is common in many rangelands and wildlife habitats. Thus the overall statistics about population densities of the herbivores in an area often do not provide a clear picture of the actual grazing pressure that is occurring at a specific study site and it is necessary to monitor grazing activity more intensely, e.g. by counting faecal pellets.

Exclusion of one major grazing animal from an area can make the vegetation more attractive to other herbivores. These animals may be able to access the ungrazed forage through the fencing designed to exclude the intended herbivore. This can distort the picture that may be drawn from studying the exclosure and the possibility of such problems should be considered at the beginning of the study. Discriminatory or serial exclosures that prevent access by certain species and allow others to graze should separate their impacts. Close monitoring of the intensity of grazing by different herbivores inside and outside of the exclosures should also be part of data collection procedures. This factor is especially crucial where the availability of food for different herbivores is different. Sheep and cattle are normally bounded by paddock fencing and shift to less favourable species as forage becomes limiting. Kangaroos and feral goats however can cross paddock boundaries and move to areas with better forage. Rabbits are normally confined to the peripheries of their home range and their populations decline during droughts.

Sampling procedures and their standardisation

The long term nature of exclosure studies means that personnel in charge of data collection will invariably be replaced by others. Thus, sampling procedures must be well documented so that new staff can continue to collect data in a repeatable manner. Photographs taken from different directions can provide objective records of the vegetation that can be referred to and re-evaluated whenever new questions arise. Taking videotapes with sufficient spatial references to make them repeatable is another possibility.

The question of whether to record all individuals or to sample the population needs to be thought through. This can be a particular problem in monitoring seedling recruitment, establishment and survival. Eventual over-crowding of study plots by some species could lead to *ad hoc* decisions being made to vary the sampling procedure resulting in possible statistical unreliability and difficulties in adequately interpreting the data.

Replication and statistical reliability of the recorded information

Exclosure studies are usually difficult to replicate because of limitations on time, staff and funding resources. Remoteness can exacerbate the problem. Lack of replication can reduce the statistical validity of the results and be a major flaw in their acceptance (Hurlbert, 1984; Stewart-Oaten *et al.*, 1986).

Strong spatial heterogeneity at varying scales can make replicates practically useless. The behaviour of vegetation within every set of replicates may be so different that they could not be considered as samples from a single entity.

If the establishment of large experimental plots was affordable, then allocating sufficient sub-sampling locations within the exclosure and similar grazed areas may be an option.

The difficulties in establishing adequate replicates has led marine ecologists to develop a method known as BAIC (Before, After, Impacted and Control; Underwood, 1991). In this method, both the experimental plot (equivalent to grazing exclusion in rangelands) and the control are first monitored to provide baseline information about the dynamics of the biotic communities (i.e. plant populations in the rangelands) under annual and seasonal climatic cycles. This will also reveal if there is any innate difference in the behaviour of communities within the treated and control sites. The treatment (grazing exclusion) is then applied. If the magnitude and direction of the dynamics of vegetation within the exclosure differ from that of the pre-treatment period, and if these changes do not parallel those of the control site, then the observed difference is attributable to protection from grazing. Appropriate statistical analyses have been developed to use this method (ibid). Despite all of these efforts, there is still the possibility that populations at the "impacted" and "control" sites may show different responses to future environmental factors. Thus, it is necessary to have more than one control site to eliminate the problems of spatial differences that may arise in time (Underwood, 1991).

The need for rainfall and other meteorological information

Rainfall and temperature are the most important climatic factors that should be monitored in the exclosure study sites. Spatial heterogeneity in the distribution of rainfall, and particularly rainstorms of differing intensity, can have dramatic effects on the vegetation. This makes it necessary to have raingauges installed at study sites, or in close proximity. Installation of a meteorological unit with automatic recording devices is an ideal option.

Regular data evaluation and analysis

Despite all attempts to develop suitable sampling methods, it is probable that a given procedure will present some problems and inefficiencies which can be visualised only after their trial. Thus, it is very important to regularly evaluate the collected data, particularly after each major data collection phase. This will reduce confusion or errors that will inevitably arise when old field notes and data records are eventually examined. The evaluation of data collection procedures will reveal problems and deficiencies before useful information is lost during years of repetition of faulty sampling efforts.

A Final Recommendation

I admitted that because of the very slow and/or sporadic nature of vegetation dynamics in arid and semi-arid rangelands, exclosure studies are usually very time consuming and their data collection may require a decade or more before sufficient information is available to provide baseline data. To reduce this problem, a proactive and interventionist approach can be quite helpful. Instead of setting up experimental plots and waiting for the important events to happen, they can be made to happen by designing field experiments that simulate environmental factors of interest, e.g. different regimes of rainfall, fire or flood. Obviously, these experiments can be quite costly but I believe are warranted as they may save decades waiting for the data to be collected under natural conditions.

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INTERNATIONAL CONGRESS LOOKS TO AUSSIE LAND MANAGERS

Kate O'Donnell, Communication & Publications Officer for VI International Rangeland Congress, PO Box 764, Aitkenvale QLD 4814

An international conference on rangelands, which will discuss the major issues affecting land management globally, is keen to hear from Australian land managers to make sure their views and experiences are heard by the world's top rangeland experts.

The VI International Rangeland Congress will be held from July 17-23 in Townsville north Queensland, and will bring together scientists, land managers, extension staff and government administrators worldwide.

Issues on the agenda include sustainable land management, land degradation and desertification, balancing the needs of the environment with economic reality, diversification of land use, the implications of climate change, grazing pressure and total property management.

"The theme of the congress, as we go into the 21st century, is 'People and Rangelands: Building the Future'," said Dr Gordon King, the congress's business manager. "We want to encourage people directly involved in land management in an innovative or traditional way to attend the congress."

"We are offering a number of 'scholarships' to land managers who are involved in community participation projects, in particular indigenous land use, Landcare or Total Catchment Management, and innovative or different approaches to managing enterprises in the rangelands," he said.

The scholarships will cover congress registration, which includes evening functions, lunches and most dinners. Part contributions to accommodation will also be considered.

"We would hope that the recipients will be able to produce a poster story of their activities (perhaps photographs and captions), offer their knowledge and views in discussions and workshops, and act as a "buddy" to one or two of our international guests," explained Dr King.

Just some of the countries represented at the congress are Namibia, United Kingdom, United States, South Africa, Kenya, Sweden, Canada, Niger, France, Israel, Zimbabwe and Argentina. The United Nations will also be represented. "There are a tremendous number of common themes internationally," said Dr King.

More than half the world's land area, and more than 70 per cent of the Australian continent, are rangelands — areas of natural or semi-natural vegetation in which traditionally, the major land use is grazing for livestock production. The term also covers land use for mining, recreation, ecotourism and wildlife

habitat. Increasingly, people are looking to rangelands to support multiple uses.

Chair of the congress, Professor Brian Roberts, an eminent pasture scientist and one of the founders of the Australian landcare movement, said that congress discussions and papers would be taking an integrated approach to land management.

"We'll be looking at the resources physically, but also how people survive financially." "In the congress itself we will be looking at things like how to manage grazing pressure and what people's experience has been, not only in Australia but in other countries as well," he said. "There will be all kinds of bright ideas of how people have applied lateral thinking to get out of the cycle of debt and land degradation."

There are three plenary speakers, one of whom is Dr Tim Flannery, whose book the *Future Eaters* was made into an ABC TV documentary recently. Three days of concurrent sessions will give delegates the options of choosing which papers and discussion groups will be of most interest and use to them.

There will also be six professional workshops and a number of congress tours, which will visit the properties of some of the best land mangers in the country. It is these workshops, says Professor Roberts that will also be of particular interest to land users.

"We've got a workshop on practical rangelands and rangeland ecology, that is understanding how the rangelands work — there is one on rangeland assessment which is all about condition and trend and keeping your property records. There's also a workshop on drought mitigation that will involve planning for before, during and after drought."

"Also, if there are landholders out there who are seeking more understanding of things like Native Title, they might well want to attend our workshop on cultural and biodiversity values. This workshop is an attempt to get a bit of balance into how we can move towards what we call multiple use."

"All in all, we think there is a whole lot of good stuff there for property mangers," said Professor Roberts. "People might also want to know that it's all good tax-deductible stuff!"

For more information and scholarship applications, contact:
Bronwyn Dawson
IRC Secretariat Townsville
Tel: (07) 4771 5755
Fax: (07) 4771 5455
Email: bronwyn@harveyevents.com.au

Business Manager: Dr Gordon King
Tel: (02) 9449 3670
Fax: (07) 4771 5455
Email: secretariat-irc@unsw.edu.au
Website: http://irc.web.unsw.edu.au

International Rangeland Congress Themes

- Plant invasions of rangelands
- Past impact, present struggle, future needs
- Rangelands, people perceptions & perspectives
- Understanding soil processes and desertification
- Indigenous people and rangelands
- Managing grazing pressure
- Policy, planning and institutions
- International perspectives on rangelands
- Rural development, education & communication
- Integrating land and water management
- People and rangeland biodiversity
- Accounting for rangeland resources
- Modelling for better rangelands
- Plant functional types
- Sustaining an enterprise
- Rehabilitation of mined surfaces
- Economics and ecology
- Working for better policy
- Prospects for the future of rangeland people

Professional Workshops

- Practical Rangeland Ecology & Defoliation Physiology
- Range Assessment, Rehabilitation & Monitoring
- Geographic Information Systems (GIS)/Remote Sensing as Planning & Management Tools
- Drought Mitigation Strategies and Management – sponsored by FAO
- Community Landcare and Extension
- Cultural Heritage and Biodiversity Management

ARTIFICIAL WATERS AND RANGELAND BIODIVERSITY REPORT

The Effects of Artificial Sources of Water on Rangeland Biodiversity

Jill Landsberg, Craig James, Stephen Morton, Trevor Hobbs, Jacqui Stol, Alex Drew & Helen Tongway

Published by Environment Australia and CSIRO, Canberra, January 1997. Reprinted March 1999

This comprehensive report describes the results of a three year CSIRO study that provides important new information for understanding and managing the grazing associated with livestock watering points across the Australian rangelands.

Available from:
Department of Environment and Heritage (DEH)
Community Information Unit
Phone toll-free 1800 803772.

The price is $15, plus $3 postage.

RANGEWAYS
Finding Better Ways For Land Use Planning

Felicity Gilbert, Rangeways Communications Coordinator, PO Box 4903, Kalgoorlie WA 6430

In July 1997, the *Range Management Newsletter* (*RMN* 97/2) introduced the Rangeways project as a five year, community-based research project, located in the North East Goldfields region of Western Australia. Since 1995, Rangeways has been working to find better ways of using the rangelands, and better ways of involving the community in making decisions about these uses. This has been done under the premise that any changes have to improve the well being of people living in the region, and the condition of the environment.

As Margaret Friedel's 1997 article reported, the project evolved from various concerns, including the difficult economic conditions for the pastoral wool industry in Western Australia and the need to target research effectively. In 1993, the Land & Water Resources Research & Development Corporation (LWRRDC) began shifting its focus from production-based research to the long term ecological and economic sustainability of rangelands.

LWRRDC encouraged Alec Holm, Don Burnside (then both of Agriculture WA) and Margaret Friedel (CSIRO) to develop a project that would meet these needs. They wanted to research how land use planning could be done in a way that satisfied landholders, local communities and other people with interests in the rangelands, and also achieve ecologically sustainable development. One of the key elements throughout was community consultation.

By the time Rangeways began in earnest in late 1995, it had the support of a wide group of interests. The Board and the management team together included the Goldfields-Esperance Development Commission (GEDC) Chair and CEO, WA government agency heads and senior staff, and senior representatives of pastoralists, conservationists and CSIRO. GEDC went into bat for us and successfully applied for additional funding from the federal Department of Transport and Regional Development.

Now in its fourth year, Rangeways has achieved a number of important milestones on the way to satisfying its commitment to community led, sustainable land use planning. Some highlights are:

- Widespread community consultation has been undertaken to identify land use issues for the region.
- Five sector groups have been established representing regional stakeholders.
- Consultation is underway with Aboriginal groups.
- Regional stakeholders have identified their land use priorities.
- Extensive information about the region has been collated to support community land use planning.

This information has been translated into a resource atlas.

Additional research projects have been undertaken to support and facilitate the project, including a study on policy impacting on land use planning issues.

All this has been preparing Rangeways for the project's second stage heralded by the release for discussion of LUPIS (Land Use Planning & Information System) plans, representing each stakeholder group's preferred land use allocations, scheduled for April.

The LUPIS component of Rangeways will have two distinct parts. The first step is the Development Stage. The purpose of this step is to prepare all participants in the process to engage in step two - the Negotiation Stage. Step one includes activities to enable everyone to learn about LUPIS, activities to form a Community Executive representing the sector groups, and discussions about how the Community Executive might operate.

The second step, the Negotiation Stage, is designed to reach an agreement on potential land use allocations in the North Eastern Goldfields. This step will include rounds of negotiation in which the Community Executive reaches decisions; members then take them back to their representative sector groups for approval before reporting back to the Community Executive.

LUPIS plans will be developed for the following sector groups: Tourism & Recreation, Conservation & Heritage, Diversifiers and Pastoralists. The Mining & Prospectors sector will not be included as they have no agreed set of guidelines. Aboriginal land use plans may be produced in future but will not be negotiated at this stage as consultation is still continuing.

The next few months will be a crucial and exciting time for Rangeways. The LUPIS plans will be an important tool for drawing community stakeholder groups together, to negotiate land use planning for their region, now and for the future, within a framework that allows implementation of the changes people want.

If you would like to know more about the Rangeways project, or receive our newsletter *Rangeflash*, please telephone Felicity Gilbert, Communications Coordinator, on national free call 1800 632 146, or email gma@gold.net.au.

REGISTERED OFFICE OF THE ARS

Manda Page, Treasurer & Director, ARS, Department of Natural & Rural Systems Management, University of Queensland, Gatton College QLD 4345

The Council of the Australian Rangeland Society has changed the registered office of the society. The registered address is now:

The Australian Institute of Agricultural
Science and Technology
1st Floor, 91 Rathdowne Street
Carlton VIC 3035

CONFERENCE REPORT
Conservation for Ecological Sustainability

Hugh Pringle, Research School of Biological Sciences, Australian National University, Canberra ACT 2600
on behalf of the Canberra crew of CSIRO Wildlife and Ecology

This conference, held at the Centre for Conservation Biology, University of Queensland from 22-25 September 1998 was the third in a roughly biennial series of conferences dealing with conservation in the real world. Although well attended, numbers were slightly down on the previous conference.

The conference was great. We all talked about conservation problems in commercially used lands and waters, how we thought things might improve, what had made things improve and what constituted the greatest barriers to further improvement. However, it was something of a mutual backslapping exercise as there were few actual managers and barely a senior Government policy-type to be seen. We were mostly agency and academic people of similar philosophy; working towards integration of production and conservation for sustainability in all of its glorious forms!

Some of the most marked progress was noted in the sugar cane and fisheries industries where industry, researchers and general State Government agency staff were working as teams with obvious mutual respect and trust. This framework links policy, research and reality (management) in such a way that each learns from the others. That's not a bad approach.

Scale was seen as a major challenge in all three areas mentioned above. We really haven't progressed very far and yet the systems we work with aren't uniform or static. They have patterns within patterns that change at different rates through time. This makes management, research and policy formulation extremely complex. However, isn't that complexity called reality? Maybe we are kidding ourselves with simple models of what's out there and how it works? A key is to understand systems, but be able to distil that complexity down into models that are within the capacity of our brains to articulate, comprehend and implement.

An out-of-session issue was the political influence on where the public dollar is allocated. Some people felt that forests receive amounts of money well beyond what is sensible when their biological integrity is compared to alternative land use systems/regions such as the agricultural regions of Australia. In this context, rangelands may also be seen to have major conservation problems, but they may not be so 'major' when compared with adjacent agricultural landscapes.

Industry self-regulation was generally seen as the option most likely to bring about broad-scale shifts in management practice and philosophy. Several codes of practice were described and their presenters generally felt they were worthwhile. The trick in getting these grassroots initiatives working seems to be to focus on incentives to make change attractive. These incentives include both financial (e.g. stewardship payments) and non-financial (e.g. property rights).

Finally, systems of accreditation are needed for ESD-friendly produce (as opposed to the 'clean and humane' accreditation, which exists now and receives a good market premium). The rangelands are well-placed to pursue this niche market, which also will need clever promotion and may not be realised immediately.

Finally, harking back to an earlier point, we need ALL players at these conferences on sustainability. That may mean seeking public funding to support local manager and interest group involvement. And maybe we need to put pressure on our pollies to send their senior policy people to listen to what EVERYONE has to say, rather than having policy influenced purely by nurtured technocratic networks. This is something for our ARS to contemplate.

25TH ANNIVERSARY OF SOCIETY

Bruce Alchin, Subscription Secretary, School of Land and Food, University of Queensland, Gatton College QLD 4345

The Australian Rangeland Society is 25 years old in 1999!

It is interesting for those who have been involved in the Society at any time to reflect on the changes in its role and, perhaps more importantly, where it's heading to in the future.

To provide a profile for the Society's role in the past 25 years and to establish a basis for future projections and possible changes, it is intended to recognize the Society through general media releases, targeted media releases, an *RMN* issue acknowledging the past 25 years and a display at the International Rangeland Congress.

If any readers have any "memorabilia" (photos, records, comments, etc) it would be appreciated if they could be made available through me to include in the acknowledgement record of the Society. Other suggestions from readers would also be most welcome.

Please contact me by mail at the above address or by:
Phone 07 5460 1359 (wk) or 07 4696 1413 (a/h)
Fax 07 5460 1367
Email b.alchin@mailbox.uq.edu.au

Ed. Further to Bruce's article, the third newsletter for this year will be a special issue marking the Society's 25th anniversary. John Morrisey has kindly agreed to guest edit this issue for me. If any member has ideas for the special issue, or would like to contribute an article, please contact John at:
25 Elizabeth Street, Cottesloe WA 6011
Phone (08) 9384 4489

NEWS FROM COUNCIL

Peter Johnston, ARS President, Sheep and Wool Institute, Queensland Department of Primary Industries, Locked Mail Bag 4, Moorooka QLD 4105

Council has met three times since the last *RMN* in November 1998. The following summarises some issues that Council has addressed in that time.

Nominations for the Next ARS Council

Nominations are sought by the 10th April for the following positions for the next ARS Council (to be based in South Australia):

- President (SA)
- Two Vice Presidents (SA and NT)
- Honorary Secretary (SA)
- Honorary Treasurer (SA)
- Subscription Secretary (SA)

Travel Grants

Three applications for travel grants were received by the Society following a call for applications on page 19 of the November 1998 *RMN*. Travel grants were awarded to Lachlan Ingram (WA), Jane King (Qld) and Ian Auldist (NSW) to attend the 6th IRC in Townsville in July 1999. I am sure Lachlan, Jane and Ian will find the congress interesting and informative. We look forward to reading their reports in the *RMN*.

AGM

The 1999 AGM of the Australian Rangeland Society is to be held in Brisbane on Friday 28th May 1999 at 7 PM. The venue is the "A" Block Conference Room, Queensland Department of Primary Industries, Animal Research Institute, 665 Fairfield Rd., Yeerongpilly, Brisbane (entrance via Ortive St).

This AGM is a significant event as the Council for the Society moves to South Australia for the next two years (the Northern Territory after that). The agenda for the meeting will be:

- Minutes of the 1998 AGM
- Directors' Report
- Treasurer's Report
- Subscription Manager's Report
- Subscription Secretary's Report
- Publications Committee Report
- Election Report (for South Australian Council)
- Correspondence
- General Business

All members of the Society are invited to attend the meeting.

Interaction with the Society for Range Management

Bruce Alchin and others have been negotiating reciprocal membership with the US-based Society for Range Management, i.e. when you subscribe to become a member of one society there is an incentive to become a member of the other. The finer details of the arrangement are yet to be worked out. However, it is anticipated that subscription notices for the year 2000 will offer reciprocal membership.

The publication of the joint electronic bibliographic database with the Society for Range Management is still delayed. Leigh Hunt (Publications Committee) is keeping us up to date on developments in this area.

Journal Index

An index for the *Rangeland Journal* from 1986 to 1998 will be published shortly by the ARS in the same layout as the journal. Gary Bastin is to be congratulated for the work he has put into compiling, formatting and checking the index. It also includes a very useful subject index.

Survey of Members

A survey of ARS members will be conducted by a group of students from the University of Queensland during 1999. While the survey will be addressing a wide range of issues facing Australia's rangelands, members will be asked questions about the ARS and the future direction of the Society. The ARS Council will be involved in the development of the survey.

ARS Booth at the 6th IRC in Townsville

The ARS will have a display booth promoting the Society at the 6th IRC to be held in Townsville in July 1999. Council is keen to hear from members who are interested in staffing the display (see Bruce Alchin's notice on page 15. Please advise Bruce Alchin (ARS Subscription Secretary) or Eda Addicott (ARS Secretary) if you are attending the 6th IRC and are willing to be involved.

ARTICLES AND MEMORANDUM OF ASSOCIATION

Manda Page, Treasurer, Department of Natural & Rural Systems Management, University of Queensland, Gatton College QLD 4345

The Australian Rangeland Society's Articles and Memorandum of Association are now available in electronic form. If anyone requires a copy, they can be obtained by emailing any of the Queensland council members (addresses inside the front cover). The file is in Microsoft Word 97 format.

ATTENTION MEMBERS AND OTHER INTERESTED READERS!

Sally Ollerenshaw, 17 Smith St, Gatton QLD 4343

I am writing on behalf of the twelve members of our group to introduce ourselves. We are fourth year students of Gatton College, University of Queensland completing a Natural Systems and Wildlife Management Degree this year (1999).

A project we have been assigned to undertake throughout the year is to work closely with the Rangeland Society and it's members to evaluate membership issues and in particular reasons for fluctuations in membership over recent years. To follow on from that we will be looking at the implications that these reasons have for sustainable development and management of the rangelands today.

We see **you** as our main audience and are very interested in your honest opinions, views and perspectives related to rangeland management. We would like to give you the chance and opportunity to voice your concerns by way of a survey which will be distributed via mail within the next 6-8 weeks and/or at the IRC held in Townsville this year.

Your time and contribution to this survey is highly valued. It will be analysed by ourselves and others with expertise to be presented as a report that will assist the rangeland Society in carrying out its objectives.

Ultimately, our aim is to integrate the various perspectives of members to improve understanding and communication between all managers of the rangelands so that we all come out as winners!

If you would like further information please feel free to contact either/or:

Anika Tauchmann
PO Box 1343
Lawes QLD 4345
ph: (07) 5460 1430

Sally Ollerenshaw
17 Smith St
Gatton QLD 4343
ph: (07) 5462 8377
e-mail: s344435@student.uq.edu.au

Leanne Thompson
e-mail: s344462@student.uq.edu.au

SOCIETY STAND AT THE IRC

Bruce Alchin, Subscription Secretary, School of Land and Food, University of Queensland, Gatton College QLD 4345

The ARS is proposing to have a stand at the IRC at Townsville.

Details are yet to be finalised, but assistance will be required from members to assist with inquiries at the stand. (From the experience at the previous Congress, this is a personally very enjoyable and valuable task). Any members who would like to participate in promoting their Society through this activity should contact me at the above address or:

Phone 07 5460 1359 (wk) or 07 4696 1413 (a/h)
Fax 07 5460 1367
Email b.alchin@mailbox.uq.edu.au

NEW MEMBERS

Malory Weston
Centre for Environmental Management
University of Ballarat
PO Box 663
Ballarat VIC 3353

A Brandis
Department of Conservation & Land Management
64 Weir Road
Harvey WA 6220

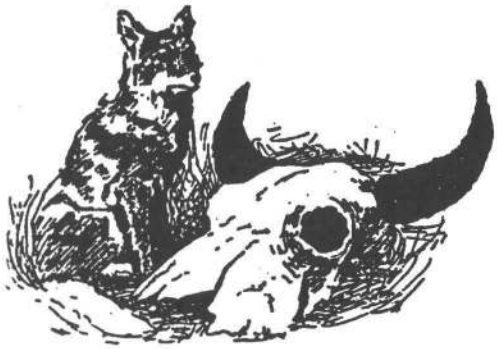
Mr Bob Wynne
35 Turner Street
Condoblin NSW 2677

Delphine Bentley
Department of Natural Resources
PO Box 224
Charleville QLD 4470

Dr Mark Howden
CSIRO Wildlife & Ecology
GPO Box 284
Canberra ACT 2601

Pastoralists & Graziers
1st Floor, Pastoral House
277-279 Great Eastern Highway
Belmont WA 6104

Kathleen Richardson
c/- Lands, Planning & Environment
Pastoral Division
PO Box 30
Palmerston NT 0831



CALL FOR SPECIAL SESSION PROPOSALS
2001 Society for Range Management Meeting
Kona, Hawaii

Joe Wagner, PO Box 272, Alturas, CA 96101 USA

The following information is requested with a proposal submission:

1. Symposia/Workshop Title
2. Sponsoring Person(s) – name, title, address, telephone & email
3. Duration – between 3 to 8 hours
4. List of potential speakers and topics
5. Anticipated audio-visual needs

This call for Symposia/Workshop proposals is due by June 30, 1999. Please send a hard-copy proposal to me at the above address. I can also be contacted by telephone at (530) 233-4666 or by email at jwagner@ca.blm.gov if you have questions.

The timeline for the 2001 SRM Symposia/Workshop sessions as proposed by the Program Committee is:

June 30, 1999	deadline for proposal submission
September 30, 1999	preliminary selection by Program Committee
January 15, 2000	finalisation of Symposia/Workshop arrangements

AUSTRALIAN RANGELAND SOCIETY
MEMBERSHIP APPLICATION FORM

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

I, [name] .....

of [address] .....

.....

..... Postcode .....

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

❒ Enclosed is a cheque for $AU ..... for full/part* membership for an individual/institution* for the calendar year 19 .....

❒ Enclosed is a cheque for $AU ..... for full/part* membership for an individual/institution* for the calendar year 19 .....

Card No.: ..... Expiry date: .....

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

Membership Rates:

	Australia	**Overseas**	
		Surface Mail	**Air Mail**
Individual or Family -			
Full (Journal + Newsletter)	$60.00	$70.00	$80.00
Part (Newsletter only)	$30.00	$35.00	$40.00
Institution or Company -			
Full (Journal + Newsletter)	$90.00	$100.00	$110.00
Part (Newsletter only)	$45.00	$50.00	$55.00

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

For Office Use Only:

Membership Number.....

Date Entered in Member Register.....

Date Ratified by Council.....