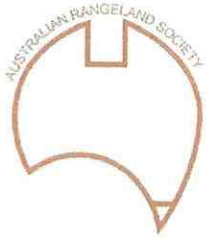

The Australian Rangeland Society

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FROM THE EDITOR

Noelene Duckett, 10 Villa Canyon Place, The Woodlands Texas USA 77382. Email: aduckett7@msn.com

Welcome to the final issue of the *Range Management Newsletter* for 2008.

This issue begins with some Society news. Carolyn Ireland has taken over the role of Secretary for the ARS. For those of you who don't know Carolyn, she is a great asset to Council (as you can see from her profile!) – I am sure that she is looking forward to her new role. Also, the news has spread that the ARS Conference held in Charters Towers was a great success – I have included some photos taken at the conference and a great summary poem written by Kaz Johnson.

Two major articles are included in this newsletter. Firstly, I have included a co-authored report from the 2006 Heaslip Arid Zone Research Scholarship winner Shashika Richards and also Dionne Walsh. Shashika's project reassessed the effectiveness of soil rehabilitation techniques that were established on Bond Springs Station, near Alice Springs, forty years ago. This is an interesting study of how different methods have stood the test of time and is well worth the read. Additionally, Gary Bastin has submitted an article highlighting details of a new ACRIS report investigating the impacts of environmental, economic and social change across Australia's rangeland using data from 1992 to 2005. This report is of interest to the wider rangeland community (NRM groups, Indigenous land managers, industry and corporate groups, and researchers) in addition to government – check out what it is all about on page 9.

The next issue of the newsletter is due out in March 2009. To make this deadline, please have articles to me by late January/early February. I am excited about the opportunities of publishing the newsletter on-line in the near future. Stay tuned for details!

Finally, best wishes to everyone for a safe holiday season.

THE AUSTRALIAN RANGELAND SOCIETY WELCOMES A NEW SECRETARY

Carolyn Ireland recently took over the role of Secretary for the Australian Rangeland Society. Sandra Van Vreeswyk had been acting in this position since the resignation of Vanessa Bailey earlier in the year.

Carolyn will perform a number of roles for the Society including:

- Acting as the front-line person for correspondence between the public, Society members and Council;
- Preparing the agenda for Council meetings and taking the minutes;
- Undertaking any follow-up activities; and
- Director of the Society and signatory on the cheque account.

Carolyn's contact details are as follows:

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Brief Profile

Carolyn is a rangeland botanist and ecologist involved in land use studies, vegetation surveys and other natural resource management matters. She is currently a member of the South Australian (SA) Arid Lands NRM Board, a member of the SA Dog Fence Board and a Sessional Commissioner for the Environment, Resources and Development Court.

Her research led to the award of a PhD concerning the sustainable management of the Western Myall (*Acacia papyrocarpa*) woodlands in SA under pastoral land use. For 10 years a member of the Pastoral Board of South Australia, Carolyn participated in the evolution of a system of pastoral land management which is arguably of international best practice. As a member of a number of committees she was influential in the integration of diverse community interests and Commonwealth and multi-state administrations leading to the formation of the Lake Eyre Basin Coordinating Group for the ongoing integrated natural resource management of the Basin. As an independent practicing professional Carolyn has developed her consultancy Ireland Resource Management Pty Ltd into a self-sustaining enterprise, servicing contracts as diverse as peer review and advice for the Environmental Impact Statement of the current Olympic Dam Expansion to vegetation surveys of the islands of remote Lake Gairdner National Park. As a staff member of North Flinders Mines Ltd she was responsible for the EIS in relation to the proposed development of the Dead Bullock Soak Mine in the Tanami Desert region of the NT.

Her passion is integrated natural resource management, especially in arid areas. These lands, particularly in Australia, contain some of Australia's most intact ecosystems and natural biological diversity. However, the challenges of sustainable growth and development in the region remain.

REFLECTIONS FROM THE AUSTRALIAN RANGELAND SOCIETY CONFERENCE

CHARTERS TOWERS, 28TH SEPT - 2ND OCT 2008

Kaz Johnson, ESRMP, Department of Agriculture and Food, PO Box 110, Geraldton WA 6530.
Email: kjohnson@agric.wa.gov.au

We arrived from near and travelled from far,
By plane. On hoof. Big bus or by Car.
Quite pleased to be away from the office and bowers,
To catch up and yarn at the majestic - Charters Towers.

The venue chosen for the even to be held,
Quite appropriate and sentimentally titled 'The World'.
We were made up of serious, wise and humorous jokers,
Involved in the talks, the forum, the field and the posters.

With field trips designed to spread the projection,
Like ants we scuttled in every direction.
Day one finished off with a treat local made,
With drinks and a steak at the Stock Exchange Arcade.

Entertaining presentations yielding little crowd yawning,
But heads full of thoughts_ it warranted warning.
On leaving the theatre, consider head load,
And don't forget, "Look both ways when crossing the Road".

Discussed how we'd get them, then how we'd store 'em,
The pensioners helped out with wisdom in Youth Forum.
The marketing winner, torn between sifters and sorters,
Was to run a new series of "Rangelands: McLeod's Daughters".

There was fashion real bright and outfits quite tatty,
They put in the effort and took out the quiz. Well done Gone Batty.
We had wigs of Pink and gaudy flower print shirts,
But the winner, by far – Dennis in his short turquoise skirt.

During the days and through to the night we made new mates,
Setting the scene for the well informed and the passionate debates.
The commitment entwined in discussions amazing,
Be it in systems, monitoring, buffel or even cell grazing.

Building relations through policy, finance and social adversity,
Working towards learning, conserving, Rangeland biodiversity.
The Students presentations were great to see energetic faces,
Committed to Rangelands and Research, you're all sure to go places.

Whether we'd come from the West. South. North or the East,
We all enjoyed digging in at the Desert Knowledge CRC feast.
There was dining and dancing and prizes of pretty high stakes,
The girls of JK were awarded the inaugural prize of "The Jakes".

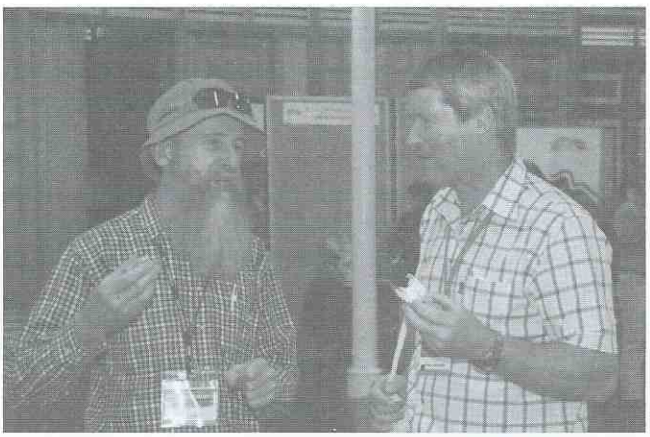
Some bleary eyes and tired faces, stumbled in and sought out seating,
Very progressive and all updated at this mornings ARS meeting.
Diversity, Research, Monitor, Develop and Assess,
Equipped with our tools there's huge chance for success.

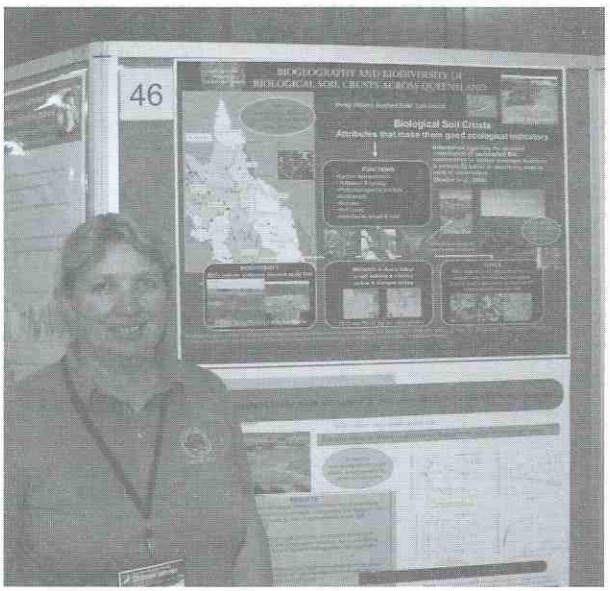
As well as the sponsors we can't fail to thank,
The numbers involved in the conference think-tank.
From high-rise, to bark-hut, to bush or from city,
This wouldn't have happened without the organising committee.

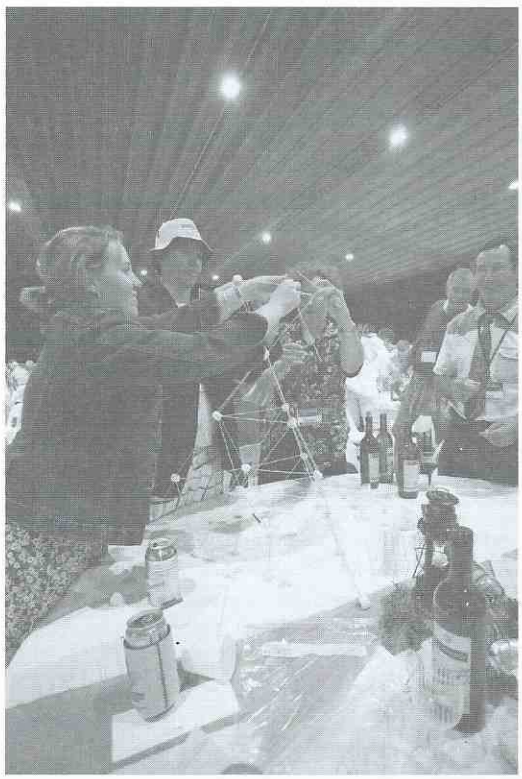
To both Jackie and Janine we can place our affections,
For their skills of arranging from the mob at JK Connections.
Grazing day long, we'll all need to walk a few mile,
Defeating the purpose of this co-ordinated feedlot trial.

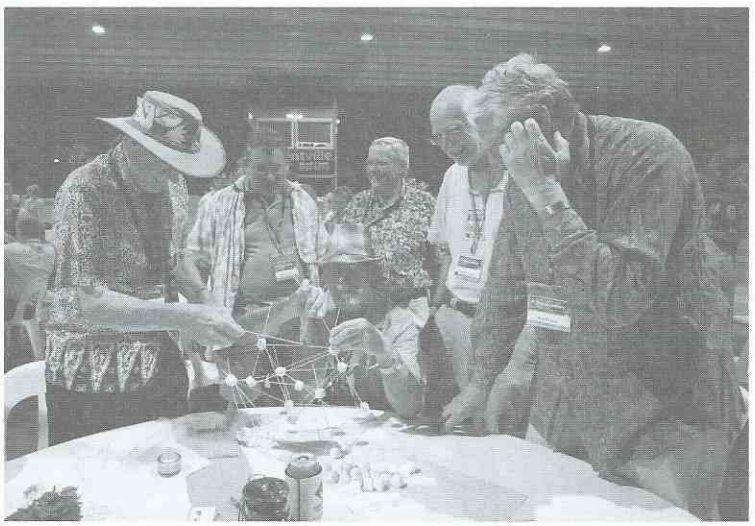
So, as we depart, we'll each take a token
With memories and notes of what has been spoken.
Armed with a passion and equipped with new names,
We'll take to our Rangelands on the new winds of change.

CHARTERS TOWERS CONFERENCE PHOTOS









Photos by: Alan Kwok (alankwok@internode.on.net) and others. More conference photos can be viewed at the ARS website (www.austrangesoc.com.au) and also at http://www.pbase.com/alankwok_au/rs (password - arc).

A REASSESSMENT OF SOIL REHABILITATION WORKS ESTABLISHED ON BOND SPRINGS STATION (ALICE SPRINGS) IN 1968

Sashika Richards, Former Student St Philips College, PO Box 33, Alice Springs, NT 0871.

*Dionne Walsh, Paddock to Profit Services, 6 Wallace Ct, Katherine, NT 0850. Email: rdwalsh@bigpond.com**

**Corresponding author*

Background

This project was undertaken by Sashika Richards, who was the recipient of the 2006 Heaslip Arid Zone Research Scholarship. The scholarship, which is funded by the Heaslip family of Bond Springs Station, is awarded annually to a senior high school student showing aptitude in science. The scholarship program is designed to expose students to all the skills required to take a rangeland science project from concept stage through to final promotion. The scholarship aims to give students a "head start" in their tertiary studies and helps to educate young people about their local environment in central Australia.

Abstract

This study reassessed the effectiveness of soil rehabilitation techniques that were established on a site near Alice Springs in 1968. Aerial photography and visual inspections confirmed that most of the treatments established in 1968 have disappeared from the landscape. One of the treatments that has persisted (absorption banks) was assessed in more detail to determine its success in rehabilitating the land. The results show that the banks have been effective in trapping moisture, nutrients and seeds, leading to enhanced vegetation growth. None of the species sowed on the site in 1968 have persisted and natural seeding has been the source of the vegetation seen today. Soil data indicate that salinity and pH do not appear to be limiters of plant establishment on this site. Rather, it is believed that harsh soil surface conditions are probably preventing the widespread germination of seed and the survival of seedlings.

Introduction

Erosion occurs when soil is disturbed and moved by water and wind. This can be a natural process (e.g. weathering) or accelerated by the activities of humans. In central Australia, the most common forms of erosion are sheet, rill and gully erosion caused by water and soil drift and dust storms caused by wind.

Soil drift and dust storms occur when the soil is lifted from the surface and moved by wind. Fine soil and silt can be transported long distances by the wind but coarse sand is usually only moved small distances. Sheet and rill erosion occurs when rain disrupts bare soil, freeing particles (Gunter, 2003). If there is a lot of rainfall, a surface film of water is created which leads to sheet water flows. As the water flows, it removes finer soil particles, causing the site to lose some of its nutrients and moisture holding capacity. These flows of water can become concentrated into deep, faster-flowing channels. Gully erosion occurs when concentrated flows of fast-flowing water remove large amounts of soil from depressions and drainage lines (Gunter, 2003). This soil is deposited in other parts of the landscape such as rivers and lakes (Gunn, 2005).

Several precautions can be taken in order to prevent accelerated wind and water erosion. Runoff can be reduced by vegetative cover which intercepts rain drops before they hit the soil surface. Dense vegetation also slows the speed of the water making it less erosive and allows it to infiltrate the soil. Wind erosion can also minimised by reducing animal impacts on the vegetation and soil surface. Where erosion has already occurred, rehabilitation techniques can be implemented using machinery. In central Australia, these techniques have included pitting, ponding, opposed disc ploughing, ripping and staggered furrowing. These techniques have different effects on the soil due to the amounts of water and nutrients that they trap and the depth of the soil opened up (see Friedel *et al.* 1996).

The Bond Springs Trials

Between 1956 and 1966, central Australia suffered its worst drought on record. At this time, much of the ground cover suffered from the lack of rain, leaving the soil highly susceptible to wind erosion (Keetch, 1981). The Bond Springs weather records show that only 42mm of rain fell at the station homestead in 1956. In light of the erosion impact on the droughted country and the need to better understand the soils of central Australia, a trial was initiated at Bond Springs Station in 1968. This trial aimed to compare different soil rehabilitation techniques, including the seeding of local and non-local species such as kapok bush, WA buffel grass, Molopo buffel grass, Gayndah buffel grass, Ti Tree buffel grass, birdwood grass, turkey bush, witchetty bush, blue bush, old man saltbush, creeping saltbush, mulga, supplejack and guar. The soil rehabilitation techniques trialled were tyne ridging, contour ploughing, pitting, strip scarifying, strip discing, complete ploughing, spiral ploughing, contour ripping and absorption banks. After the works were done, the vegetation response in the trial area was assessed in January 1969 by Barney Foran. Unfortunately no further reports have been located despite extensive searching. We revisited the site on the 30th March 2006, and noticed that the absorption bank treatments seemed to have persisted the best. We therefore decided to assess this treatment for this study.

Absorption banks consist of low earth banks constructed across the contour to slow water flows in order to trap moisture, nutrients and seeds that would otherwise be washed away into creeks and drainage lines (Ballenger, 2001a). They are typically constructed so that when full, water will spill out each end of the bank to be intercepted downslope by another bank. Absorption banks are best

suited to areas with imperceptible slope and are much lower in height than ponding banks typically built in central Australia (D. Torlach, pers. obs.). Absorption banks allow moisture to infiltrate the surface and they trap nutrients and organic matter which helps to improve the condition of the soil and allow for the re-establishment of vegetation cover (Bastin *et al.*, 2001). Twenty eight absorption banks were established on the Bond Springs site in 1968.

This study aimed to assess the effectiveness of the banks by comparing vegetation cover inside ("upslope") versus outside ("downslope") of the banks. We also assessed whether any of the plant species sown in 1968 had persisted on the site. It was predicted that there would be a higher amount of vegetation inside the banks than outside the banks, as the soils inside the banks would most likely be of a higher quality and hold moisture and seed. We also collected and analysed several soil samples to characterise the soils across the ponded area and undertook a visual comparison of aerial photography for the site spanning 35 years.

Methods

Study Site

The research site for this project was located on Bond Springs Station, about 25km north of Alice Springs. A hand-drawn map of the site was located in the historical files. In order to improve the accuracy of this map, a GPS was used to map the boundaries and corner pegs of the paddock. Each of the 28 absorption banks was also mapped using the track log function on the GPS. The existing steel posts inside each bank were also mapped and were fitted with a permanent numbered metal tag to aid future re-location.

Aerial Photography

Aerial photography taken in August 1980 (1:15,000), November 1987 (1:25,000) and August 2006 (1:6,000) was sourced from the NT Department of Natural Resources, Environment & the Arts. Using these images, a visual assessment of the persistence of the different rehabilitation techniques was made. A number of low-level aerial photographs taken from a light aircraft were also located and showed the vegetation response a year or two after the work started.

Measuring Vegetation Cover

Fourteen of the 28 absorption banks were randomly selected using a random number table to assess vegetation cover and composition. A second random number table (using numbers between one and ten) was used to select five quadrat sites inside (upslope) and five quadrat sites outside (down slope) for each bank as follows. Starting at the northern end of each bank, the 1–10 random number table was used to specify the number of steps to be taken between quadrats (Figure 1). A 1m x 1m quadrat was laid on the ground at this point and percentage vegetation cover was estimated. All plant species growing in each bank were also identified and recorded.

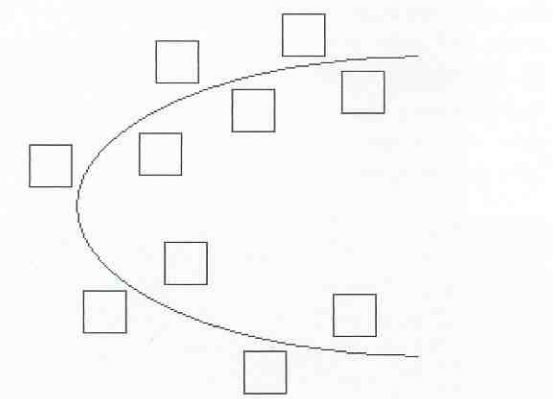


Figure 1: A random number table was used to determine the location of quadrats inside and outside the 14 banks.

Soil Samples

Four of the absorption banks were selected to represent the range of soil types apparent on the site. These were Banks 1, 7, 14 and 25. A soil pit was dug inside each bank, approximately one metre from the wall of the bank. Another pit was dug outside each bank, again, approximately a metre from the wall of the bank. GPS readings of these pits were taken.

The soil pits were dug to a depth of about 30cm using a spade and a drill mounted percussion spade. The hardness of the soil prevented deeper pits from being dug and we were most interested in the upper layers and their possible impact on grass and herbage growth anyway. The depths where obvious soil changes (e.g. colour or texture) occurred were measured using a tape measure. Soil samples were then collected from each section and processed as follows. Soil was scraped off the surface layer and put through a sieve. The percentage of gravel left behind in comparison to soil was then estimated. A small section of the non-gravel portion was moistened and worked in the palm to determine the soil texture. This moist soil bolus was then used to determine the colour of the soil using a Munsell Colour Chart. A small sample of dry soil was then placed on a ceramic plate and moistened with the dye from a pH soil testing kit. Powder from the kit was then added and the colour was compared to the chart in the kit to get an estimate of soil pH. This was done for each layer of soil in each pit. A sample of the soil was also collected from each layer and placed in a labelled bag for salinity testing in the laboratory. These samples were left to settle for a few days indoors before being processed.

In the laboratory, 20g of each soil sample was air dried, weighed on a digital balance and then placed in 100ml of distilled water. This was placed into a Griffin flask shaker and shaken for four hours. The samples were then left to settle for several days. Decanted samples were then tested with a conductivity and pH meter which measured the salinity in parts per million.

Results

Aerial Photography

The following low-level oblique 35mm photographs taken from a light aircraft in 1969 or 1970 clearly show the different soil treatments on the site (Figure 2).

Figure 2: Low level aerial photography clearly showing the contour ploughing, absorption banks, pitting and spiral ploughing. The top photo also shows a strong vegetation response in the treated areas.

High-level aerial photographs for 1980 and 1987 (Figures 3 & 4) show that most treatments were still clearly visible on the site however, some were starting to fade. The absorption banks (in the upper right) and pitting (bottom centre) appear to be the clearest and the spiral is still visible.

The 1:6,000 aerial photograph taken in the year of the study (Figure 5) shows that only the absorption banks and pitting treatments were still visible on the site. These results were confirmed by visual inspection on the ground which found little to no trace of the other treatments. One of the changes that had occurred at the site since 1987 was the construction of a higher, longer straight bank in the vicinity of original Bank 5 which can be seen in the 2006 photograph.

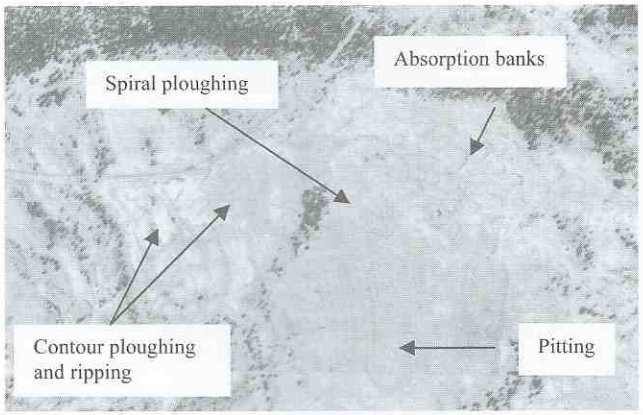


Figure 3: An enhanced photo image of the site in 1980 (1:15,000). Spiral ploughing, absorption banks, contour ploughing, contour ripping and pitting are still visible on the site.

Figure 4: An enhanced photo image of the site taken in 1987 (1:25,000). Spiral ploughing, absorption banks, pitting and contour furrowing are still visible on the site.

Figure 5: An enhanced photo image of the site taken in August 2006. Absorption banks and pitting are the only techniques visible on the photography.

Vegetation Cover & Composition

The average vegetation cover inside the banks was 25.6% and the average vegetation cover outside the banks was 12.1% (Figure 6). The most commonly found species inside the fourteen absorption banks were *Scleroleana crenata* (11 banks), *Tripogon loliiformis*, *Sida sp.*, *Sclerolaena eriacantha* and *Goodenia lunata* (all found in 10 banks). The least common species were *Trianthema*

triquetra, *Atriplex sp.*, *Euphorbia drummondii*, *Diplachne fusca*, *Acacia aneura* and an unidentified daisy (all found in only one bank). None of the species that were originally planted in 1968 seem to have persisted on the site. Despite this, there is a diversity of native species that have self-sown, many of which are 'pioneer' species (annual plants that colonise bare and/or disturbed ground).

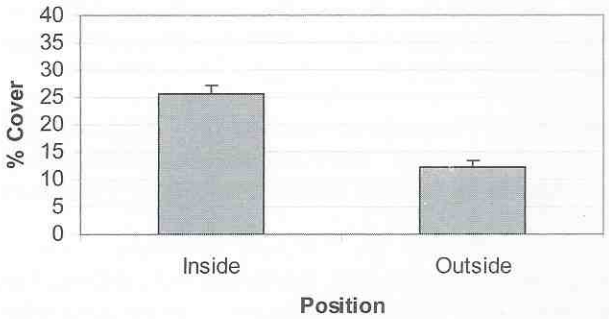


Figure 6: Vegetation Cover on Bond Springs Ponding Banks. Vegetation cover was significantly higher inside banks than outside them. Error bars are Standard Errors.

Soil Samples

With one exception, the sites generally had acidic to neutral surfaces (Richards, 2006). Below the surface layer, soil pH ranged from 5.5 (on Banks 1 and 14) to 9 on Bank 7. Soil textures ranged from clays to sandy loams. Salinity ranged from 13.2 parts per million (ppm) on Bank 14 to 136 ppm on Bank 7.

Discussion

Reassessment of the rehabilitation works at Bond Springs was challenging due to the lack of sequential data collection over the 35 years since the trial was established. All that was available to us was a hand-drawn map, a description of the treatments, a few photographs and a short report from 1969. The GPS mapping of the absorption banks and the boundaries of the site showed that the original hand-drawn map was somewhat inaccurate. It is likely that other treatments have been misdrawn on the original map and this could be corrected by mapping the treatment marker pegs using a GPS.

Aerial photographs taken over the 36 years show that the some of the mechanical treatments have faded away. Up until 1987, all of the soil rehabilitation works were still visible on the site, including absorption banks, spiral ploughing and contour ripping. The August 2006 photo shows that absorption banks and pitting have been the most persistent soil rehabilitation techniques on the site. Ground observations confirmed that absorption banks have been the most effective at growing vegetation, albeit in a narrow zone close to the banks themselves. Grant (1994) noted that whilst "a good response was achieved in the first year while the surface treatments intercepted runoff, subsequent results were poor and the trial was abandoned in 1970 (from AIB internal file 64/10)". The aerial photographs show that some of the banks had been breached as early as 1968 or 1969. This suggests that the banks may not have been surveyed or constructed accurately and that water flow had concentrated at low points in the banks instead of overflowing around the ends of the banks as should occur. These breaches would certainly have reduced the effectiveness of the rehabilitation.

Jackson's (1962) description of the Bond Springs soil family being non-calcareous with neutral to acidic surface reactions was confirmed by the soil data collected in this study. We also confirmed that the soils had massive vesicular structure and very low salinity (Jackson, 1962). Observations of the soil pits indicated that the soils downslope of the absorption banks were drier than inside the banks. This was particularly noticeable on Bank 7. The soil pits were dug a few days after rain and it was expected that the soil would be moist as a result. However, this was not the case. The soil on the inside of Bank 7 was very moist, showing that the bank had done its job effectively. However, the soil from the outside of Bank 7 was bone dry at all depths. The vegetation response to this was reflected in the cover, with average cover outside of Bank 7 being 4% in comparison to the inside which was 20%.

Although high salinity levels can limit plant growth in parts of central Australia, this study has shown that this is probably not the case on the rehabilitation site at Bond Springs. The highest salinity reading was 136 ppm (found downslope of Bank 7 at a depth of 28 – 35 cm). This compares to areas of the Alice Springs Golf Course which have readings of >100,000 ppm and soils around St Philips College which range from 200 to 3,300 ppm (D. Torlach, unpublished data). To put these figures in context, the salinity of sea water ranges from 30,000 – 40,000 ppm.

On average, there was higher vegetation cover inside the banks than outside the banks. This showed that the absorption banks have been effective in reducing the effect of sheet erosion by trapping moisture, nutrients and seeds so that vegetation can grow as a protective cover. Twenty eight different plant species were found on the site. The only species that was planted on the site in 1968 that is present today was mulga (*Acacia aneura*), however the mulga seed was sown in a different bank to the one that it was found in during our study. Therefore it can be concluded that nothing that was originally sown on the site has persisted. All of the species found in the banks in 2006 are native Australian species that are commonly found in central Australia. This would suggest that for this site, seeding with native species, or relying on natural seed dispersal is the preferred option for revegetation. Most of the species that have established in the banks are "pioneer" species, which are short-lived plants that colonise eroded or disturbed ground. Work elsewhere in central Australia has shown that after five or six ponding events, palatable perennial grasses can become established on areas where remnant topsoil remains whilst the annual grasses and pioneer species tend to colonise the bare and scalded areas (Purvis & Bastin, 1990). Grant (1994) suggested that the relatively slow response to the reclamation works in the Bond Springs trial area was because "the reclamation work has been undertaken on soils presenting inherently difficult conditions for plant growth". These conditions included the presence of hard-setting surfaces, the shallowness of the A horizon and evidence that water infiltration into the

slightly saline clayey B horizon was poor (Grant, 1994). It would be interesting to see if mechanical works that increase infiltration (such as deep pitting or scarifying) would improve the vegetation response on the site. Areas of the paddock away from the ponding treatment that contained cracking clays were noted to be supporting species such as Mitchell grass (*Astrebla pectinata*).

It was also observed that the vegetation growth was being heavily grazed by kangaroos. In addition to breaks in the banks, this may have been reducing the effectiveness of the regeneration. Previous studies in central Australia have confirmed that banks require regular maintenance and some rest from grazing in order to allow plants to establish and set seed (Keetch *et al.* 1996; Ballenger, 2001b). Since the trial was established, local experience has determined that banks should ideally be built to a height of 1 to 2 metres to maximise their life (Purvis & Bastin, 1990; Sugars & Dance, 2003). Furthermore, banks are now usually built using material "borrowed" from downslope of the bank to avoid exposing subsoil above the banks which may be less conducive to seed germination. Soils on the Bond Springs site naturally slump with wetting and drying cycles and it is likely that the low absorption banks (<20cm) on this site will eventually fade away.

Conclusions

This study is significant in that it has reassessed the effectiveness of a long-term rehabilitation site in central Australia. The study has demonstrated that:

- Absorption banks and pitting have persisted the best on the Bond Springs site.
- Absorption banks have been effective in trapping moisture, nutrients and seeds, leading to enhanced vegetation growth.
- None of the species sown in 1968 have persisted.
- The soil type and surface conditions were probably not suitable for the species introduced in 1968.
- Soil salinity and pH do not appear to be limiters of plant establishment on this site.
- Natural seeding (where there is a seed source close by) is the preferred option on the site.
- Ongoing maintenance such as the fixing of breaches is necessary to improve the effectiveness of absorption banks.

Acknowledgements

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RANGELANDS 2008 – TAKING THE PULSE

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The Australian Collaborative Rangelands Information System (ACRIS) Management Committee recently released a major report on change in the rangelands. *Rangelands 2008 – Taking the pulse* describes change in a number of biophysical and socio-economic themes (see Table 1). The reporting period is 1992 to 2005 and reporting is mostly by bioregion (with statistical local areas used for reporting some socio-economic data).

The report was requested by the Natural Resources Management Ministerial Council to "investigate the impacts of environmental, economic and social change across the 81% of Australia's land area classed as rangeland". It should provide a firmer basis for planning and evaluating investments made by government in the rangelands. The content should also provide more objective information for 'state of the environment' type reporting.

As well as the primary audience (government), the report should also be of interest to regional natural resource management (NRM) groups, Indigenous land management organisations, industry groups, corporate agriculture, researchers and any with a general interest in the rangelands.

ACRIS

ACRIS is a partnership between agencies of the Australian Government and rangeland states (including the NT) that are responsible for natural resource management (NRM), biodiversity conservation and primary industry based on the rangelands' natural resources. Representatives of the various agencies form the Management Committee that governs ACRIS activity and direction.

The state agencies contribute interpreted monitoring data that are then collated across jurisdictions and synthesised with higher-order analysis (i.e. meta-analysis) by a Management Unit to periodically report change in the rangelands. Funding for the Management Unit and some related ACRIS activities has been provided by the Australian Government and administered by the Desert Knowledge Cooperative Research Centre. State and NT partners have also made substantial investments through their monitoring programs and other rangeland NRM activities.

The title of the report ('Taking the pulse') derives from the dynamic but sometimes fragile nature of the rangelands, and the need to monitor the way in which this large part of Australia (81% of land area) responds to human impacts. As medical staff take our pulse as a measure of our health, so we take the 'pulse' of the rangelands to determine how they are changing through time. The analogy is strengthened by viewing satellite images of vegetation growth over a 10–20 year period. The sequential images appear as a beating heart, as vegetation greens (and grows) each summer in the monsoonal north, most winters in the south and irregularly in the arid interior.

Report Contents

The report is structured into six chapters plus an appendix:

Chapter 1: Introduction
: This chapter provides an overview of Australia's rangelands and ACRIS's role in assessing changes in its natural resources.

Chapter 2: Assessing change
: Concepts and approaches in monitoring and assessing changes in the rangelands are presented.

Chapter 3: Change in the rangelands
: Subject to data availability, national results are reported for each of the ACRIS themes (see Table 1 for themes). As noted above, the reporting unit is bioregion (mostly) and we emphasise regional differences in producing the national view.

Chapter 4: Focus bioregions
: Regional case studies are used to highlight results and specific issues in selected rangeland bioregions.

Chapter 5: Emerging information needs
: Indigenous land managers, regional natural resource management (NRM) groups and the non-government environment sector are considered emerging clients for ACRIS-type information. ACRIS can evolve to meet the perceived information requirements of these stakeholders. There is also potential for some of these groups to contribute monitoring data that can enrich ACRIS as the information system for the rangelands. Again, ACRIS needs to adapt to realise this potential.

Chapter 6: ACRIS — data into information
: Integration and information management – using the information system. In this final chapter we demonstrate how the various biophysical and socio-economic datasets can be integrated to produce more complete information about change in the rangelands. Such syntheses should contribute to adaptation of policy and delivery programs that are most appropriate to the rangelands. An important point from the synthesis is that the rangelands are characterised by variability and there is 'no one size fits all' in terms of policy and programs.

Appendix: Jurisdictional reporting
: An update (since 2000) from each ACRIS partner on its ongoing rangelands information activities. The detail of jurisdictional monitoring programs was originally provided in *Rangelands – Tracking Changes, the Australian Collaborative Rangelands Information System* (published by the National Land & Water Resources Audit (2001), Australian Government, Canberra, Australia).

A CD accompanying the printed version of the report has a hypertext-linked version of the complete report plus summarised information for each of the 52 bioregions wholly or partly within the rangelands.

The Department of Environment, Water, Heritage and the Arts (DEWHA) has produced a printed summary highlighting key results. This booklet (*Australia's Rangelands 2008: At a Glance*) includes the CD with the complete report and bioregion summaries.

Reporting Themes

Themes covered in the Results section of the 2008 report are listed in Table 1.

Table 1. Themes and information types reported in *Rangelands 2008 – Taking the pulse*.

Theme	Information type
Climate variability	• seasonal quality as context for interpreting change
Landscape function	• change in landscape function
Sustainable management	• change in critical stock forage • change in pastoral plant species richness • distance from stock water • invasive weeds
Total grazing pressure	• change in domestic stocking density • change in kangaroo density • feral herbivores
Products that support landscape function and sustainable management	• change in fire regime (extent, intensity & frequency) • change in atmospheric dust (dust storm index)
Water resources	• information sources for water availability and sustainability
Biodiversity	• change in protected areas • change in number & status of threatened species / communities • habitat loss by clearing • effects of stock watering points on biota • fauna records and surveys • flora records and surveys • transformer weeds • wetlands: condition and change • habitat condition derived from remotely sensed ground cover • bird composition
Socio-economics	• socio-economic profiles • value of non-pastoral products in the rangelands • change in land use • change in pastoral land values

Summarised Results

Highlight results were presented at the 2008 rangelands conference in Charters Towers and are summarised below. Please note that this is a summary and that quite often caveats and additional explanation accompany these results. Thus the reader is encouraged to access the complete reporting in *Rangelands 2008 – Taking the pulse*.

Climate variability

Rainfall variability obviously has a big effect on environmental change in the rangelands. In reporting results, the Management Committee has used methods to 'see through' this variability to better understand the effects of grazing on pastoral country.

In summary, seasonal quality between the early 1990s and 2005 was generally above-average in the north and north-west of Australia, variable in much of central Australia, initially above average in most of the WA and SA shrublands followed by drier-than-average conditions, and below average followed by drought conditions in the eastern grasslands and mulga lands.

Landscape function

Landscape function provides a measure of the landscape's capacity to capture rainfall and retain nutrients in the top soil. These are the essential resources for plant growth, and in turn, good livestock production.

The majority of pastoral monitoring sites in 26 bioregions in WA, SA, NSW and the NT suggest an increase or stability in landscape function given the trends in seasonal quality and known stocking densities from 1992 to 2005. Reported change is for the local area of monitoring sites, not the whole of each bioregion.

Five bioregions in Queensland showed seasonally adjusted stability or increase in landscape function from road-traverse data. Six bioregions had decreased landscape function.

Critical stock forage

ACRIS uses the term 'critical stock forage' to report the relative abundance of those plant species that sustain long-term carrying capacity.

From pastoral monitoring data in WA, SA, NSW and the NT, critical stock forage remained stable or improved at the majority of monitoring sites in 28 bioregions with suitable data for reporting, despite periods of low seasonal quality and variable stocking density. Stability may be an unfavourable result for sites located in degraded landscapes.

Reporting for Queensland is based on estimated levels of pasture utilisation. Utilisation was above a safe level for much of the area of three bioregions. Parts of another five bioregions had utilisation levels that were of concern.

Livestock density

Regional livestock densities tend to track seasonal conditions. Where regional density remains high as

seasonal quality deteriorates, this should be an alerting mechanism for further monitoring to ensure that the land resource is not damaged through overgrazing.

Stock densities consistently declined between 1992 and 2005 in some south-eastern bioregions (e.g. Riverina, NSW and SA) and consistently increased in some northern bioregions (e.g. Pilbara, WA). Elsewhere, stocking density broadly tracked seasonal quality. However there is evidence from some pastorally important bioregions that recent stocking density has remained high as seasonal quality has deteriorated.

Kangaroos are a significant component of total grazing pressure in the southern and eastern rangelands, where they contribute 20 to 40% (and more) of livestock grazing pressure in some years. Feral herbivores contribute significantly to grazing pressure in parts of the rangelands. The distributions of feral animals are known reasonably well but reliable data on regional densities are generally lacking. This has prevented us from compiling a complete picture of regional change in total grazing pressure.

Fire regime

Across northern Australia, up to 40% of some tropical savanna bioregions burn each year.

Altered fire regimes are having significant impacts on components of the native flora and fauna.

Biodiversity

The lack of systematic monitoring data means that definitive reporting of recent changes in biodiversity is not possible. The available evidence suggests that:

- There is no reason to believe that the historical declines in rangeland biodiversity have ceased given current land uses and the time lags in the biological responses. This assumption is backed by documented declines in the detection rates of some bird species by the Birds Australia volunteer network.

- The Collaborative Australian Protected Areas Database (1997-2004) documents significant changes in management intent for some areas, most notably in the Great Victoria Desert and Central Ranges bioregions where Indigenous communities have agreed to manage very large areas for biodiversity conservation.

- There has been a significant reduction in the extent of woody cover due to broad-scale clearing in a limited number of bioregions on the eastern margin of the rangelands (Queensland and NSW). Case studies show that loss and fragmentation of habitats has affected several rangeland species.

- In many pastorally productive regions, increased numbers of water points have reduced the area remote from water. Water-remote areas may make a de facto contribution to biodiversity conservation, as lower grazing pressure in these areas may provide refugia for biodiversity. Additional requirements are that any invasive species present (weeds and animals) are controlled and remote areas are suitably linked to provide an enlarged network of protected area.

Pastoral land values

Pastoral land values can indicate relative profitability, asset-to-income ratios and the ability to service debt.

Data sources vary between the states and NT and this produces some issues in comparing trends across jurisdictions. Notwithstanding this difficulty, land values increased in the order of 150-300% for many pastorally important bioregions over part or all of the 1992-2005 reporting period. These increases were far more than could be accounted for by increases in productivity (turn-off of meat and/or fibre).

What Next?

The ACRIS Management Committee and the ACRIS Management Unit are in the process of promoting the report's contents to agencies and regional groups with responsibility for natural resource management. Part of this promotion includes the need for ongoing and expanded monitoring of natural resources, the capacity of individual groups or agencies to contribute and improved ways of sharing data and knowledge. The ACRIS Management Committee then needs to conduct appropriate evaluation to judge the impact of the report's contents in better informing rangeland policy and the programs (and other forms of assistance / incentives) that help implement such policy.

This formal evaluation should help the ACRIS Management Committee set the future direction (and workplan) for ACRIS to be the valued information system for sustainable use and management of the rangelands.

As part of improving ACRIS, the Management Committee has also consulted (through contracts) for:

- improved information delivery through a more effective web site (currently http://www.environment.gov.au/land/management/rangelands/acris/index.html),

- the design and indicative cost of a nationally consistent and systematic program for monitoring biodiversity in the rangelands, and

- recommendations for reporting state (condition) as well as change in the rangelands.

How to get a Copy of the 2008 Report

For copies of the main report or the summary and CD-ROM, please contact John Lumb, Department of the Environment, Water Heritage & the Arts (email john.lumb@environment.gov.au). The report and associated material will also be available at www.environment.gov.au/acris

INFORMATION SNIPPETS

Review of the Environment Protection and Biodiversity Conservation Act

An independent review of the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) has been announced by the Federal Government.

The review, to be undertaken by Dr Allan Hawke with the support of a panel of experts, is the first review of the EPBC Act since its commencement on 16 July 2000. The review is being carried out in accordance with section 522A of the EPBC Act and will assess the operation of the EPBC Act and the extent to which its objects have been achieved.

In particular, the review will examine:

- the operation of the EPBC Act generally;
- the extent to which the objects of the EPBC Act have been achieved;
- the appropriateness of current matters of National Environmental Significance; and
- the effectiveness of the biodiversity and wildlife conservation arrangements.

The panel of experts includes: The Honourable Paul Stein AM, Professor Mark Burgman, Professor Tim Bonyhady, and Rosemary Warnock.

The review is to be completed by October 31, 2009.

Stakeholder and community input and involvement will be important components of the review. The review is currently accepting public submissions through a written submissions process. Submissions will close 5pm on 19 December 2008.

For further information about the review, details on how to make a written submission and also to register your interest in receiving notification of publications and events related to the review, go to:
www.environment.gov.au/epbc/review/about/index.html

New Landscape Restoration Report Released

Land and Water Australia recently released a report entitled *Restoring Landscapes with Confidence: an evaluation of the science, the methods and their on-ground application.* This report was commissioned by LWA as a timely assessment of the extent to which the research, tools and information that are currently available on landscape restoration are being used by regional natural resource management agencies and other organisations to achieve on-ground outcomes.

The study "examined how well the science that has been undertaken in the past is embedded in day-to-day practical approaches, and investigated what makes research relevant, meaningful and able to be easily integrated. In cases where the available research is not being used, questions were asked about what were the impediments: lack of knowledge about or access to the research?, a lack of capacity to understand and apply the science?, the format in which the science is presented?, whether it is perceived as relevant to a particular region or project?, or whether a lack of scientific credibility or other social factors intervened?"

Both the full report and a factsheet are available for download from the LWA website:

For the factsheet go to:
http://products.lwa.gov.au/products/PN21576

For the full report go to:
http://products.lwa.gov.au/products/PN21578

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AUSTRALIAN RANGELAND SOCIETY AWARDS

The Society has two awards to assist members with either:

- travel expenses associated with attending a conference or some other activity, or
- studies related to the rangelands.

Applications for each award will be considered on a yearly basis and close in November of each year. Any member of the Society interested in either award is invited to apply.

Australian Rangeland Society Travel Grant

This grant is intended to assist eligible persons to attend a meeting, conference or congress related to the rangelands; or to assist eligible persons with travel or transport costs to investigate a topic connected with range management or to implement a program of rangeland investigation not already being undertaken. The grant is available for overseas travel and/or travel within Australia. It is not intended for subsistence expenses.

Australian Rangeland Society Scholarship

This scholarship is for assisting eligible members with formal study of a subject or course related to the rangelands and which will further the aims of the Australian Rangeland Society. The scholarship is available for study assistance either overseas or within Australia. It is not intended to defray travel expenses.

How to Apply

Members interested in either award should submit a written outline of their proposed activity. Applications should clearly address how the intended activity (ie. travel or study) meets the aims of the Society. Applications should be brief (less than 1000 words) and should be submitted to the Secretary, Carolyn Ireland, before **30 November.** An application form can be downloaded from the ARS website at www.austrangesoc.com.au. For further information contact Carolyn by phone on (08) 8370 9207 or email at cireland@irmpl.com.au.

Conditions

Applications for the Travel Grant should include details of the costs and describe how the grant is to be spent. Applications for the Scholarship should include details of the program of study or course being undertaken and the institution under which it will be conducted, and information on how the scholarship money will be spent. For both awards details of any other sources of funding should be given.

Applications for either award should include the names of two referees.

Finally, on completing the travel or study, recipients are required to fully acquit their award. They are also expected to write an article on their activities suitable for publication in the *Range Management Newsletter* or *The Rangeland Journal* as appropriate, and for the Australian Rangeland Society website, within six months of completion of their travel or study.

Eligibility

No formal qualifications are required for either award. There are no age restrictions and all members of the Society are eligible to apply. Applications are encouraged from persons who do not have organisational support.

There is a restriction on both awards for overseas travel or study assistance in that the applicants must have been members of the Society for at least 12 months. The awards can be for Australian members to travel to or study overseas or for overseas members to travel to or study in Australia.

MEMBERSHIP APPLICATION FORM

The Australian Rangeland Society

TAX INVOICE / RECEIPT ABN 43 008 784 414

Please complete and return to the Subscription Manager, Graeme Tupper, PO Box 141, Orange NSW 2800.
Ph (612) or (02) 6361 7734: Fax (612) or (02) 6362 5719: grmtupper@yahoo.com.au

I, [name] .....

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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/student/company* for the calendar year 2008.

(* delete as appropriate)

☐ Charge my Mastercard VISA Bankcard AU$.....for full/part* membership for an individual/student/institution* for the calendar year 2008.

Card No.:_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ Expiry Date: .....

Signature:..... Date: ..... Cardholders Name:.....

If you were introduced to the Society by an existing member please include their name here .....

Please list details of your institution & student number if you are applying for student rates .....

Membership Rates; GST inclusive	**Australia**	**Overseas Airmail**
Individual or Family -		
Full (Journal + Newsletter)/Student	$85.00/$65.00	$105.00/$85.00
Part (Newsletter only)/Student	$50.00/$35.00	$60.00/$40.00
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Full (Journal + Newsletter)	$115.00	$140.00
Part (Newsletter only)	$65.00	$75.00

- All rates are quoted in AUSTRALIAN currency and must be paid in AUSTRALIAN currency.
- Membership is for the calendar year 1st January to 31st December. Subscriptions paid after 1st October will be deemed as payment for the following year.

Australian Rangeland Society Privacy Statement. Consistent with national privacy legislation, the Australian Rangeland Society (ARS) will only use members' personal contact information for keeping its records up to date, and enabling member access to ARS products and services e.g. meetings, events, newsletters, journals and conferences. ARS will not use members' information as supplied to ARS for any other purpose and it will not disclose the information to any other party without the member's consent. This will be achieved through email communication or any other means as appropriate.