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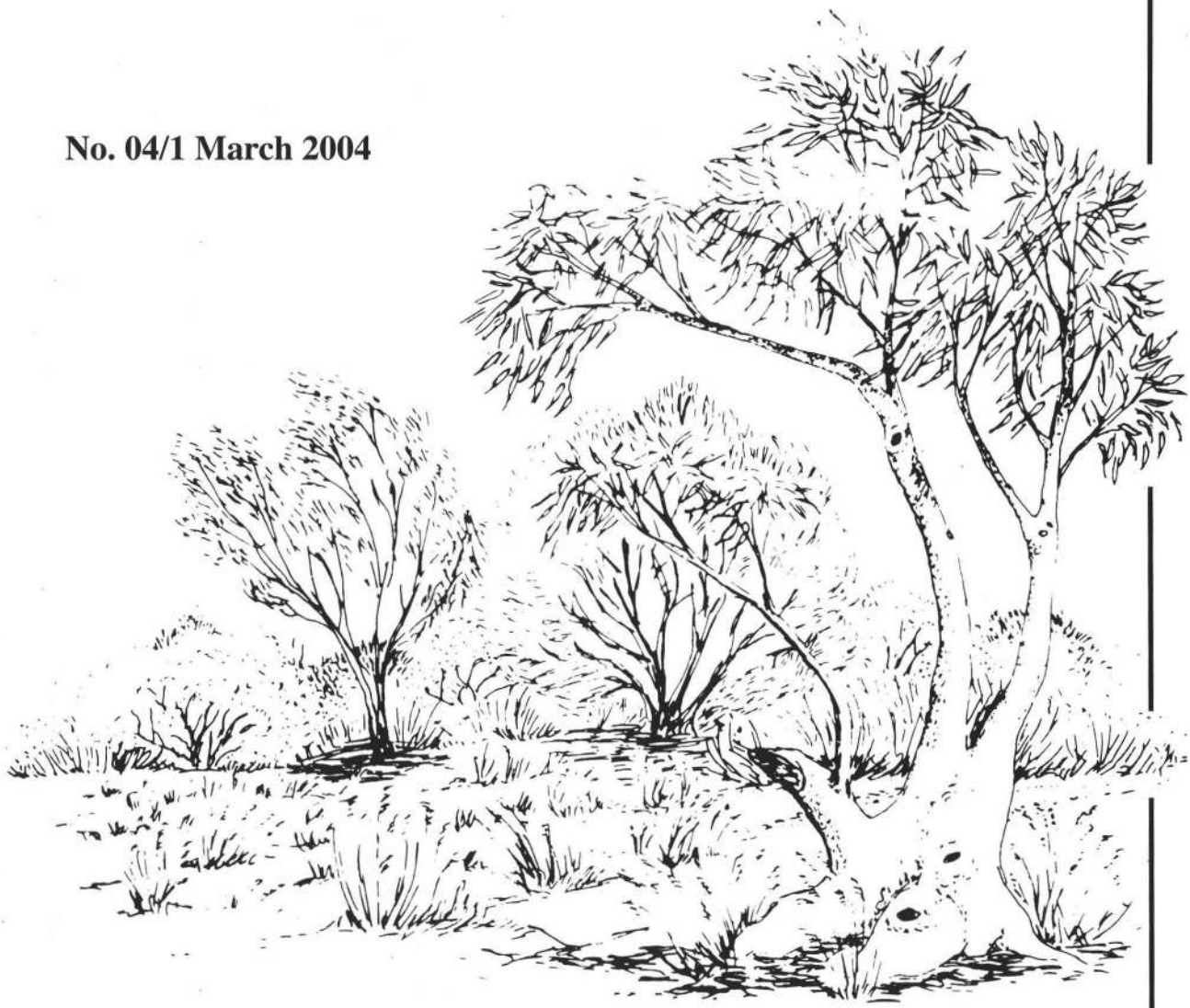

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No. 04/1 March 2004

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FROM THE EDITOR

Noelene Duckett, 7 Belcarra Place, The Woodlands, Texas, USA, 77382. Email: nduckett@ozemail.com.au

Welcome to the first issue of the *Range Management Newsletter* for 2004.

Two major articles have been included in this issue. Firstly, Gary Bastin and others have contributed another interesting article in their series on the use of high-resolution remote sensing to detect the relative leakiness of rangeland landscapes. In this article they look more specifically at the effect of video imagery pixel size on the leakiness index. The second major article is based on a study carried out by a young researcher, Lija Walton, who was chosen as the inaugural Heaslip Arid Zone Research Scholarship holder. This scholarship is a collaborative initiative with the Heaslip family of Bond Springs, St Philips College and the Centralian Land Management Association. Lija's study took a short term look at the changes in pastoral vegetation near Alice Springs following fires of differing intensities.

Following on from these studies are a number of items which should be of interest to members. Vol Norris has contributed a brief article outlining the Lake Eyre Basin Agreement and the roles of the Community Advisory Committee. On a sad note, this issue also includes obituaries for two inspirational Australian rangeland scientists, Rayden Perry and Ted Moore, who both passed away recently. There is also the usual Information Snippets section which details some new publications and some awards currently available.

As usual, the newsletter contains a number of articles pertaining more directly to the Society. These include a summary of the recent activities of Council, information about the ARS Bursaries (applications close on the 30th June) and information about the upcoming 13th Biennial Conference. The Conference is to be held in Alice Springs from 5-8 July. Registration information will be sent out soon and will also be made available on the Society's website (www.austrangesoc.com.au). Note that early bird registration for non-ARS members closes on the 16th April. You may be interested to know that the Society is currently looking for a webmaster to manage the ARS website – contact David Wilcox if you are interested.

Additionally, I am also pleased to include an article by Tim Ferraro, the Finance and Audit Officer, which summarises the current financial position of the Society. For completeness, Tim has included the financial statements for the last three years (2000, 2001 and 2002) as these have not previously been published in the *RMN*.

The next issue of the newsletter is due out around the time of the Biennial Conference. I would like to receive contributions for this issue by late May if at all possible to allow time for editing and printing.

POTENTIAL OF MULTI-SCALE VIDEO IMAGERY TO INDICATE THE LEAKINESS OF RANGELANDS

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Summary

In recent years we have developed and tested an index based on very high-resolution remote sensing that ranks the relative leakiness of sloping landscapes in arid and semiarid rangelands. In this article, we report on the sensitivity of this index to changes in the pixel size of video imagery (scale) and its implications for monitoring rangelands. The proportions of classified cover components within a common area of multi-scale aerial videography remained stable as pixel size changed. However, index values of landscape leakiness increased as pixel size increased. This sensitivity suggests that, as with most rangeland monitoring techniques, the methodology must be applied in a consistent manner to detect real differences amongst various locations or change in the one location through time.

Introduction

In a recent issue of the *Range Management Newsletter* we described how aerial videography had been used to characterise vegetation patches in different rangeland environments (Bastin *et al.* 2002a). In a companion article (Bastin *et al.* 2002b), we reported how the cover and spatial arrangement of such patches could be used to indicate landscape function. Our focus on patches, defined as clumps of perennial vegetation and other surface obstructions (logs, rocks) that persist in the landscape, relates to their documented role in capturing and retaining rainwater, litter (organic matter) and soil (nutrients), which are resources vital for landscape functioning (Tongway and Ludwig 1997). The second *RMN* article described a directional leakiness index (DLI) derived from classified aerial videography that allowed this landscape function indicator to be expanded from single line transects down hillslopes to areas of several hectares on these hillslopes (see Ludwig *et al.* 2002 for comprehensive explanation of the DLI index).

A common feature of remote sensing, be it aerial photographs or satellite images, is the trade-off between spatial (pixel) resolution and extent of image coverage.

For example, using the same camera settings, air photography and digital videography acquired close to the ground will produce greater detail (e.g., 0.2 m pixel size) for a relatively small area compared with flying higher to obtain greater coverage but relatively less detail (e.g., 2 m pixels). Shifting to satellite imagery, Landsat TM has a 30 m pixel resolution compared with the 1.1 km pixel size of NOAA AVHRR. However, AVHRR has a much larger swath width (2700 km compared with 185 km for Landsat TM).

One of the dilemmas for those using remote sensing-based analytical techniques is to utilise imagery that covers the largest area possible but that also adequately discriminates critically important components of the landscape relevant to that technique. Available landscape metrics may be variously affected by pixel size. Cain *et al.* (1997) found that for land cover maps at catchment scale derived from Landsat TM, measures of diversity and texture were more consistent than average patch shape as map scale changed. Wickham and Riitters (1995) reported that diversity and evenness metrics were not greatly affected by changing pixel size between 4 and 80 m provided that identical land cover classifications can be generated by the various sensors that collect spectral data over this range of pixel sizes.

At smaller landscape scales (e.g., < 1 km^2), and for our leakiness index as it is currently implemented, decisions about imagery pixel size must be made on the basis of an ability to adequately discriminate resource-conserving patches, be they discrete perennial grass tussocks or larger coalescent tree and grass clumps. This suggests higher, rather than lower, pixel resolution with consequent reduced image coverage (or more images are required to cover a particular area). But how does our ability to discriminate vegetation patches change as image resolution changes, and what are the consequent effects on computed directional leakiness index (DLI) values? In this article, we report on an analysis of different pixel sizes from video imagery and its implication for monitoring the leakiness of rangelands using DLI.

Methods

Site and aerial videography

Transects of aerial videography were acquired at various flying heights (Table 1) with a digital multispectral video (DMSV) system in Kunoth Paddock approximately 30 km north west of Alice Springs (Figure 1). All transects covered a similar area of open woodland on alluvial sandy loam-sandy clay loam soils although the coarser-scale imagery obviously encompassed a larger area. Vegetation comprised scattered trees and shrubs of whitewood (*Atalaya hemiglauca*), mulga (*Acacia aneura)*, witchetty bush (*A. kempeana*), and *Senna* and *Eremophila* spp. over a sparse cover of annual grasses and forbs (mainly *Aristida contorta* and various *Sclerolaena* spp.). A small amount of rain in the few weeks preceding image acquisition had produced a faint green tinge in the herbage layer.

Table 1. Details of images included in multi-scale analysis of aerial videography.

Transect & frame	Flying height (m above ground)	Pixel size (m)	Frame coverage (m)
OW1L 35	284	0.2	148 x 115
OW1M 21	710	0.5	370 x 288
OW1H 19	1420	1.0	740 x 576
OW1V 24	2550	1.8	1332 x 1037

Transect OW1L was acquired in the afternoon (1505 hours local time) with other transects flown the following morning between 1033 and 1120 hours local time. Thus, OW1L had a shadow cast to the east of trees and larger shrubs, whereas shadows in other transects were to the west; this was accounted for in our image classification.

Image processing and spatial analysis

Images were first corrected to remove spatial and spectral distortion (see Pickup *et al.* 1995). Then images of different pixel resolution covering a common area on the ground were spatially registered to each other (Figure 1) and sequentially classified into soil and cover components (Bastin *et al.* 1999). The same generic approach was used to classify each image but threshold values between cover classes were manually adjusted for each image to best match the visual interpretation of cover types in corresponding raw imagery. Cover components were then aggregated to broader types of soil, woody vegetation, dry herbage, green herbage and litter.

Due to prevailing dry conditions and sparse ground cover, only the woody vegetation patches (with its associated litter and herbaceous ground cover) was considered to provide an indication of functioning surface obstructions. Ground inspection confirmed this as plausible because in several situations, perennial grasses were found in the accumulated leaf litter under whitewoods and other large trees. These perennial grasses were concealed by tree canopies in the video imagery and we were not able to classify them as a discrete patch component.

Statistics describing patch size and separation were calculated in ArcView Spatial Analyst. Multi-directional leakiness (MDLI, Ludwig *et al.* 2002) was calculated with customised software. We used this variant of the leakiness index because the landscape had very little slope and there was no obvious flow direction, which is required by DLI. MDLI is simply the average of directional leakiness (DLI) calculated for columns and rows of the image.

In a comparative analysis, the 0.2 m image (OW1L35) was progressively degraded to pixel sizes of 0.5, 1.0 and 1.8 m and classified with the same algorithm (using the same threshold values). Patch statistics and MDLI were calculated for different pixel size.

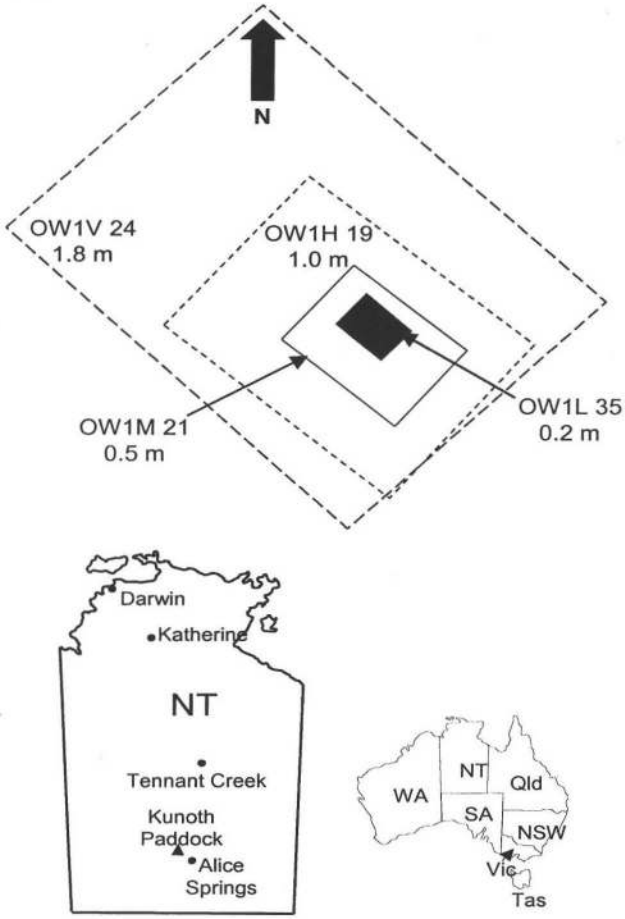

Figure 1: Spatial relationship of images used in this analysis of multi-scale aerial videography and location of the study area. The area common to image OW1L 35 was analysed.

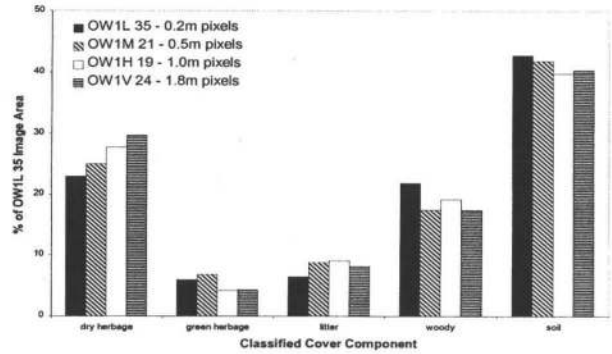

Figure 2. Proportional area of classified cover components in multi-scale video images based on the common area of image OW1L 35.

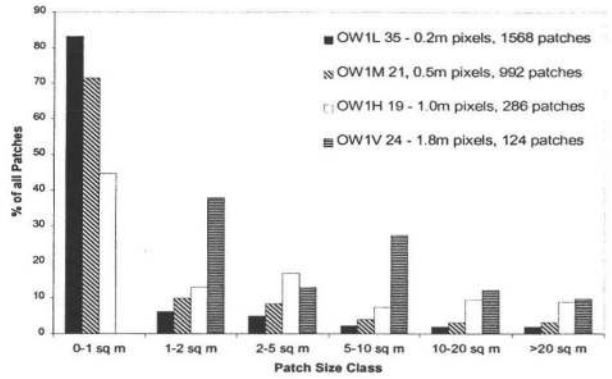

Figure 3. Proportion of patches (as a percentage of the total) in different size classes within multi-scale video images for the common area of the 0.2 m image OW1L 35. Patches are defined by woody vegetation only.

Results

Images of physically different pixel size

Classification

There were few differences in the proportional area of classified cover types for the common area of video images of different pixel size (Figure 2). The proportional area of dry herbage tended to increase as pixel size increased but we interpret this as an artefact of the slightly different thresholds used to segment this cover type.

Patch size

For all pixel sizes, there was a greater number of patches of the smaller size classes (Figure 3). Further, there was a general decrease across all pixel sizes in the proportion of patches in larger size classes. This decrease was most profound for the 0.2 m pixel size and less abrupt for larger pixel sizes. Because we were unable to discriminate patches smaller than 1 m^2 in the 1.8 m image, there were no patches of this smallest size class in that image.

Patch separation

The median distance between nearest neighbour patches increased as pixel size increased (Table 2). As with patch size, this occurs because our ability to discriminate patches smaller than the single pixel is lost and discrete patches thus become larger and further apart in images of larger pixel size.

Multi-directional leakiness

MDLI values increased, but at a declining rate, as pixel size increased (Figure 4). This is not surprising because the directional leakiness index is based on both the cover and spatial configuration of patches in a landscape. In this case, there is little variation in patch cover amongst images of different pixel size (woody component in Figure 2) but the distance between patches that can be spectrally discriminated increases considerably as pixel size increases.

Table 2. Nearest neighbour patch edge distances (m) of multi-scale imagery based on the common area of the 0.2-m image OW1L 35.

Image	Pixel size (m)	Number of patches	Minimum edge distance	Maximum edge distance	Median edge distance
OW1l 35	0.2	1568	0.28	7.25	0.45
OW1M 21	0.5	990	0.71	13.46	1.00
OW1H 19	1.0	279	1.41	13.60	2.00
OW1V 24	1.8	124	2.47	23.02	3.91

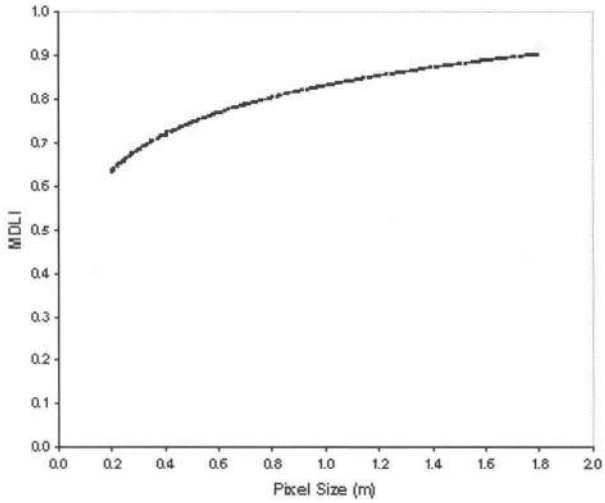

Figure 4. Relationship between MDLI and pixel size of multi-scale video images. MDLI 0 = total resource retention, 1 = no retention. The dashed line is the best-fit trend line through the four data points.

Spatial degradation of 0.2 m image

This analysis was performed to check whether slight variations in the classification procedure applied to images of different pixel resolutions may have affected classification results and subsequent spatial analyses. There were few differences in proportional cover with progressive image degradation. For brevity, these data are not shown, but percentage dry herbage increased slightly as pixel size increased (similar to Figure 2) whereas litter decreased slightly.

Discussion

Our analysis of multi-scale video imagery documents that pixel size (i.e. spatial resolution) over the range 0.2-1.8 m had little effect on our ability to classify major cover components of bare soil, dry and green herbage, woody vegetation and litter (Figure 2). There were small differences in some classified components (e.g. dry herbage) but we attribute most of this variation to slight differences in the spectral thresholds used to discriminate the cover components in each image. This reasoning was confirmed by progressive degradation of the 0.2 m image where use of a consistent classification algorithm diminished differences amongst cover components.

We would expect the consistency in discrimination of cover components to change as pixel size continued to increase towards that of high-resolution satellite imagery (e.g. Landsat TM with 30 m pixels). At 1-m pixel size larger tree canopies, for example, are represented by several pixels whereas at 30 m pixel resolution, such canopies are subsumed within one pixel. Thus, larger scale imagery loses the ability to discriminate individual patch components and starts to differentiate landscape vegetation-type components such as grassland or woodland, although methods exist for resolving sub-pixel components in some environments (e.g. Verhoeye and De Wulf 2002).

Although pixel size had negligible effect on the classification of vegetation patch-type components, it did significantly impact on our ability to discriminate the location of patches that may regulate the flow of resources through this open woodland landscape. Our binary ("yes"/"no") classification procedure meant that each pixel was labelled as either patch (i.e., trees and shrub clumps) or interpatch (i.e., bare soil and litter or annual plant-covered areas). Thus, the smallest patch was the individual pixel, meaning that there were more patches of smaller median size (Figure 3) located closer together (Table 2) in the higher resolution images compared with coarser imagery. Because the leakiness index, DLI, is sensitive to both patch cover and configuration (Ludwig *et al.* 2002), MDLI values also increased with increasing pixel size (Figure 4).

The dilemma of increasing values for our leakiness index with greater pixel size poses two issues for its use in rangeland monitoring: (1) what is the most appropriate leakiness value and (2) how does one rigorously apply the method? In answer to the first question, DLI (and MDLI) is a **comparative index** and there is no one "most appropriate" value for a rangeland image; the index is best used to compare two or more images (of different, but related areas, or for monitoring the same area over time) using the same pixel size. In response to the second, index values should indicate real change in a landscape's ability to retain resources over time if the method is used in a consistent manner at the time of each assessment. In other words, the pixel size should be small enough to adequately classify distinct landscape patches which function as surface obstructions to capture and retain resources.

As an example of the first issue, all MDLI values (Figure 4) suggest that the test landscape is "leaky" in absolute terms (0 = total resource retention, 1 = no retention). Computed MDLI values were based on our decision that only woody vegetation constituted functioning patches. Video imagery was acquired towards the end of an extended dry period in the late 1990s when most of the ground cover (Figure 2) comprised sparse forbs, annual grasses and litter. Calculated MDLI, and hence indicative leakiness, may have been substantially lower if suitable imagery were available after good rains in 2000 and 2001 when the open areas between trees and shrubs were in-filled with clumps of bunch grasses. This is the natural cycle in arid rangelands under good grazing management, and these bunch grass patches may persist for some years before succumbing to drier periods. Nevertheless, while present, they effectively contribute to improved resource retention. Thus, leakiness in more arid environments will fluctuate with rainfall variability.

Our recommended approach for dampening the effect of this inherent seasonal variability on calculated landscape leakiness is to use an appropriate reference area as the minimum leakiness term (L_{min}) in the DLI formulation (see Ludwig *et al.* 2002 for rationale, Bastin *et al.* 2002b for an example). Our test area is 5-6 km from the nearest waterpoint and near to an area used by CSIRO and the NT Government as a reference area for the open woodland landscape-type in earlier ecological research. In many respects, it meets the requirements for a reference area or benchmark and on this basis, MDLI adjusted to relative leakiness based on an appropriate L_{min} would be close to zero and likely fairly stable through time.

The scale issue of image resolution and its consequent effect on patch discrimination remains; DLI (and MDLI) is sensitive to pixel size. Where a binary classification approach is used to identify the locations of patches, it appears that one must be consistent in using imagery of the same spatial resolution to validly compare the leakiness of different hillslopes or to detect meaningful change in leakiness of the same area through time.

We are currently developing a variant of DLI based on continuous cover (e.g. PD54, Pickup *et al.* 1993) that overcomes the problem of having to classify larger pixels into binary patches or interpatches. This approach should be suitable for use with high-resolution satellite data such as Landsat TM over larger areas than is possible with aerial videography. Meanwhile, we continue our investigations into hyperspectral satellite imagery (foreshadowed in Bastin *et al.* 2002b) for its ability to resolve fractions of patch cover within larger pixels, such as the 30 m pixel data of Hyperion carried on the EO-1 satellite.

Acknowledgements

We thank the owner (Andrew Miller) and manager (Jamie Evans) of Hamilton Downs station for allowing us to work in Kunoth Paddock. Jamie also provided valuable advice on vegetation and seasonal conditions that assisted us in interpreting aerial video images.

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PLANT RECOVERY AFTER FIRES OF DIFFERENT INTENSITIES: SOME OBSERVATIONS FROM CENTRAL AUSTRALIA

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(Please note: Lija was awarded an inaugural scholarship funded by a local pastoral family to undertake a scientific research project after completing Year 12. Lija was selected due to her academic record and interest in science. This is a collaborative initiative with the Heaslip family of Bond Springs providing the funds and location, St Philips College arranging the selection of the candidate and CLMA providing the project supervisor.

The scholarship is designed to expose students to all the skills required to take a project from concept stage through to final promotion: e.g. project management, scientific methods, fieldwork logistics, statistical analysis, report writing, oral presentations and media interviews. It is believed that this will give students a "head start" in their science degree. At the same time, the pastoralist believes that we need to educate young people about their local environment and the best way to learn is to do!)

Abstract

The main objective of this project was to observe short-term changes in the regeneration of trees, shrubs and herbage species after fires of different intensities on pastoral land near Alice Springs. After the fires, ground cover increased on both burnt sites, however, cover increased faster on the cool burn site than the hot burn site. The growth rate of species was higher on the cool burn site, as were the number of plants that flowered and set seed. Interestingly, some plants that appeared to have been killed by the intense hot burn resprouted during the study.

Introduction

Exceptionally high rainfall in 2000 and 2001 followed by severe frosts in the winter of 2002 created high fuel loads in Central Australia. This resulted in the biggest fire seasons since the 1970's in the Alice Springs district.

The impact of fires on the land and on plant regeneration depends on the intensity of the fire and the seasonal conditions that follow (O'Reilly, 2001). We studied plant regeneration on two burnt sites near Alice Springs. One site had experienced a 'cool' burn that had moved slowly and occurred during the night. The 'hot' burn site experienced an intense and fast moving fire that burnt into the canopies of the trees (Grant Heaslip, pers. comm.). Intense burns can kill small seedlings and fire-intolerant species whilst cooler burns often allow resprouting of trees and shrubs (Miller, 2003). Data were collected to see which species germinated after the fires, how fast they grew and if any flowered or seeded. Data were also collected on a site that had not been burnt for comparison.

For this study, it was predicted that:

- Ground cover and pasture growth would increase faster on the cool burn site than the hot burn site due to less harsh surface conditions.
- Trees and shrubs on the hot burn site would not resprout due to the extensive damage they had suffered.

Methods

Study Site

The three research sites for this project were located on Bond Springs station, approximately 20 km north of Alice Springs (Figure 1). Each site was marked by GPS and a landscape photograph was taken on all three visits (see Walton 2003).

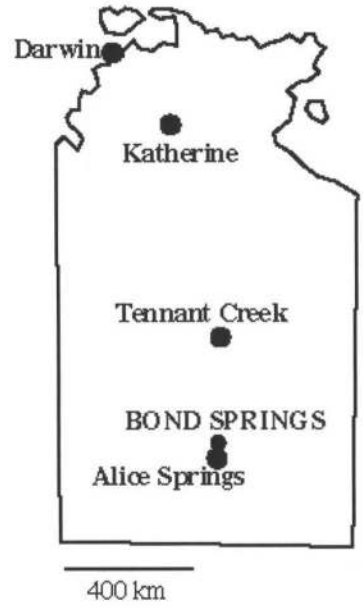


Figure 1: Location of Bond Springs station in Central Australia.

The plants found across the three study sites included:

Oatgrass* (*Enneapogon avenaceus*)
Caltrop (*Tribulus terrestris*)
Pea plant (*Swainsona sp.*).
Swainsona sp.
Sida sp.
Grey Indigo (*Indigofera* sp.)
8-day grass (*Fimbristylis dichotoma*)
Copperburr (*Sclerolaena eriacantha*)
Silky heads (*Cymbopogon obtectus*)
Mulga grass (*Aristida contorta*)
Umbrella grass (*Digitaria coenicola*)
Tar vine (*Boerhavia coccinea*)
Paddy melon (*Cucumis myriocarpus*)
Acacia bush (*Acacia victoriae*)
Whitewood (*Atalaya hemiglauca*)

Caustic weed (*Euphorbia drummondii*)
Bush tomato (*Solanum sp.)*
Spiny saltbush (*Rhagodia spinescens*)
Broombush (*Senna* sp).
Fork-leafed corkwood (*Hakea eyreana*)
Long-leafed corkwood (*Hakea suberea*)
Witchetty bush (*Acacia kempeana*)

*common names from Strong (1987) and Urban (1990)

Data Collection

The three study sites, each 100m^2 in size, were chosen with the guidance of the station owner Grant Heaslip. Site 1 was the 'unburnt' site and had not been burnt for 25 years. Site 2 was classified as a 'cool burn' site as the fire, which occurred in November 2002, was of low intensity (Grant Heaslip pers. comm.). Site 3 was classified as a 'hot burn' site as the fire was an intense fire-storm that obliterated most plants in it's path, leaving the earth bare and plants charred. Within each of these sites, three 1 m^2 quadrats were randomly selected as the plant sampling locations. These permanent quadrats were used to measure the number, growth, mortality and reproduction of all species present. They were also used to gain an appreciation of cover change over time.

On the first visit, up to five plants of each species in each quadrat were marked with numbered metal pins. The heights of these plants (to the tip of the highest stem or leaf) were measured to the nearest 0.1 mm using a standard 30 cm ruler. As the plants grew taller, a tape measure was used instead of the ruler. Where shrubs and trees had resprouted on the burnt sites, the length of the longest shoot for up to three plants of each species was measured in the same way. The plant measurements were repeated three times: 3/12/02, 12/12/02 and 26/2/03.

Results

The 2002/3 summer started dry and many fires had occurred in the Alice Springs area prior to the study. These fires were followed by good rainfall in November 2002 (Figure 2).

During the initial site visit it was noticed that many seedlings had germinated and small plants had begun to grow at this early stage in the project. Between the initial site visit and the second visit, the weather was hot and dry, and the average height of some species decreased due to shriveling. Many seedlings died off completely.

Figure 3 shows the average height for the numerically dominant species on each site at the start and end of the project. It can be seen that the copperburr and mulga grass grew significantly on the unburnt site but the oatgrass and umbrella grass significantly decreased in height. Observations indicate that the decline in oatgrass height was due to the death of many small seedlings that germinated after the November rains. The reduction in height of the umbrella grass was due to grazing. On the cool burn site, tar vine, caltrop and pea plant increased significantly in height whilst swainsona, paddy melon and umbrella grass decreased in height. Observations confirmed that the swainsona and paddy melon suffered mortality and that the umbrella grass was grazed. On the hot burn site, whitewood, silky heads, sida, grey indigo and an unknown grass showed increases in height over the study. On this site, the bush tomato and another unknown grass died prior to the end of the study.

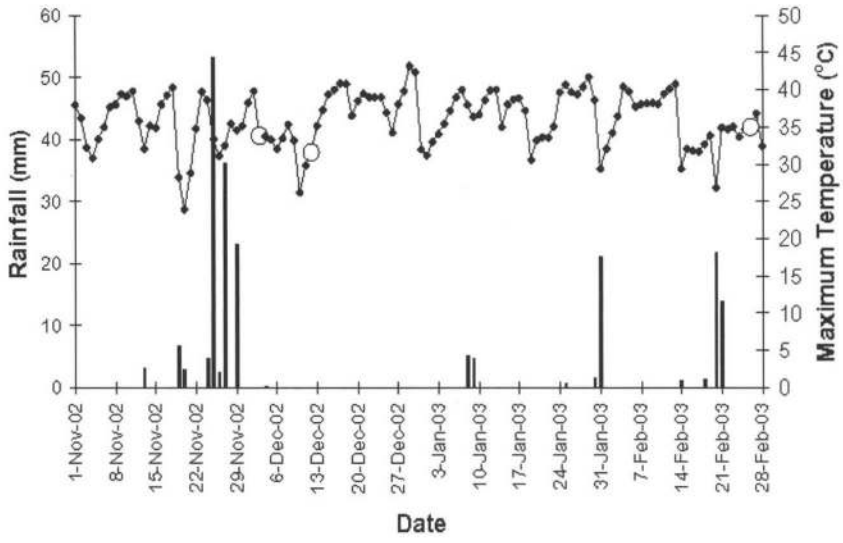
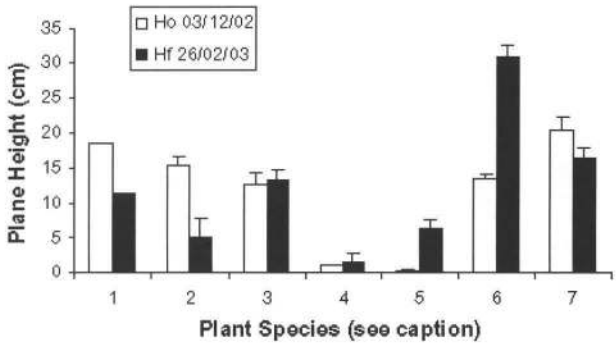
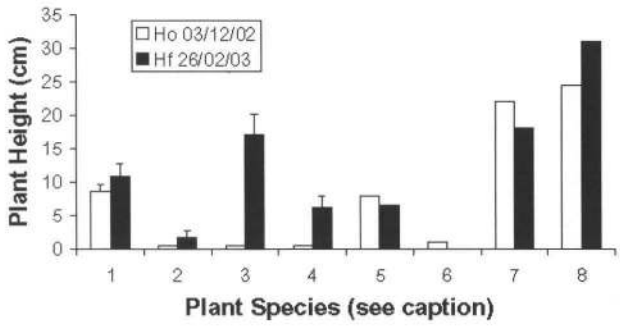


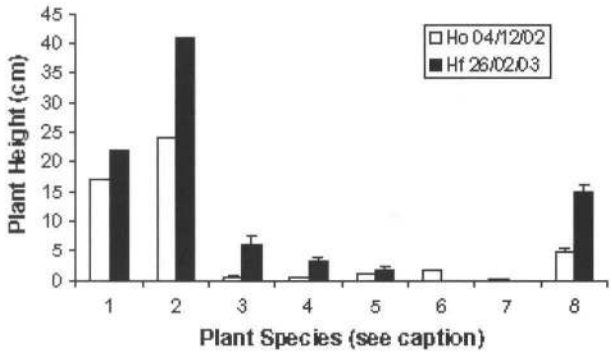
Figure 2: The rainfall and maximum temperature for the days of the project, with the site visit dates marked by open dots on the temperature graph.



(a) Unburnt site. Species include: 1 = 8-day grass;2 = Oatgrass;3 = Caltrop;4 = Swainsona;5 = Copperburr;6 = Mulga grass; and 7 = Umbrella grass



(b) Cool Burn site. Species include: 1 = Oatgrass; 2 = Caltrop; 3 = Tar vine; 4 = Pea plant; 5 = Swainsona; 6 = Paddy melon; 7 = Umbrella grass; and 8 = Acacia bush.



(c) Hot Burn site. Species include: 1 = Whitewood; 2 = Silky heads; 3 = Sida; 4 = Grey indigo; 5 = Caustic weed; 6 = Bush tomato; 7 = Grass 1; and 8 = Grass 2.

Figure 3: Average plant height for dominant species on each site. Ho represents original average height and Hf represents final average height. Error bars represent Standard Errors.

Figure 4 shows that ground cover on all three sites increased over the length of the project. Even though many of the small plants that germinated actually died, the more-established plants, such as the grasses, larger shrubs and resprouting trees continued to grow and thrive. As predicted, the cover on the cool burn site increased faster than on the hot burn site.

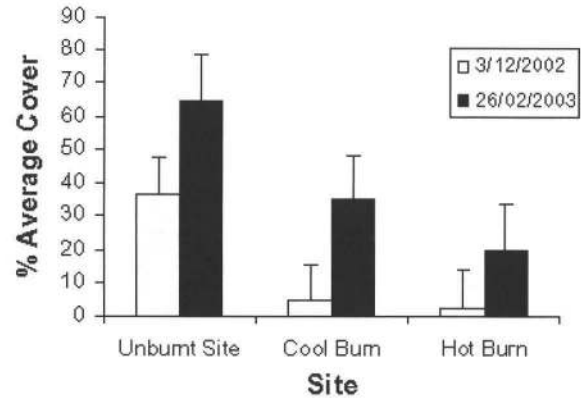


Figure 4: Average vegetation cover across sites. Error bars represent Standard Errors.

High plant mortality was evident on all three sites. Table 1 shows that caltrop seedlings had the highest mortality on the unburnt site, whereas 8-day grass was more persistent. The data for the cool burn site show that oatgrass seedlings had the highest mortality rate. The high mortality on all sites (including the unburnt site) suggests that small seedlings are very prone to high summer temperatures.

Table 1: Plant mortality on a per-site basis.

	Number of Plants 03/12/02	Number of Plants 26/02/03	Mortality (# dead)	Mortality (%)
Unburnt Site				
Oatgrass	52	17	35	67
8-day grass	354	273	81	23
Caltrop	96	1	95	99
Pea plant	258	51	207	80
Cool Burn				
Oatgrass	202	54	148	73
Caltrop	153	51	102	67
Pea plant	151	52	99	66
Tar vine	44	20	24	55
Hot Burn				
Grey indigo	29	29	*note	0
Pea plant	2	2	0	0
Caustic weed	8	3	5	63
Grass 2	55	25	30	55
Sida	31	26	5	16

*NB: On the middle visit (12/12/02) new plants had germinated, then died off.

With regards to reproduction, it was found that only herbage species were able to recover, flower and set seed during the study. No shrub species reproduced during the study. On the first visit only 8-day grass was setting seed and this was only on the unburnt site. Ten days later seeds were noticed on mulga grass, oatgrass and 8-day grass on both the unburnt and cool burn sites. At the final visit some of the surviving caltrop and swainsona plants had begun to flower. No flowering or seed set was observed on the hot burn site.

Discussion

Species Germination and Survival

It was fortunate that after the fires of November 2002, regions on Bond Springs station received quite good rainfall. The project started soon after these rains, when the daily maximum temperatures were lower and cloud cover was relatively high. The species that appeared as new germinations on the sites include 8-day grass, caltrop, pea plant, sida, tar vine and grey indigo. Other species, such as the acacia bush, broom bush and whitewood were noted to have resprouted on the cool burn site.

In comparing the unburnt site with the cool burn site, different species were found after the fire and rain even though the sites had similar species before the fires (Grant Heaslip, pers. comm.). The main differences were in the decline of grasses and edible plant species on the cool burn site, which in combination with the lower biomass, would have had a somewhat detrimental effect on the cattle production at Bond Springs at this particular site.

Mortality of plants is frequently expected in the arid zone. In comparing the total species count on the unburnt, cool burn and hot burn sites studied at Bond Springs, it is evident that the mortality rate of new plants can be very high. As soon as the rain fell the plants germinated in large numbers, but as the daily temperatures hovered in the thirties they rapidly died off. Interestingly, mortality did not appear to be higher on the hot burn site, which might have been expected due to the harshness of the microenvironment around the plants.

It is interesting to note that on the hot burn site, which was previously all spinifex, that no spinifex regeneration occurred at all throughout the project. In this case, the hot burn had made way for other plants to germinate and grow. The hot burn cleared out the relatively unpalatable spinifex, which will take several years to recover. In the meantime rainfall is predicted to promote a wide range of other species, some of which may be more useful for cattle production. In the absence of rainfall, however, land affected by a hot burn requires a long recovery period and is at risk of soil erosion if cover remains low.

Growth Rate Comparison

The data collected on growth rates of species in this study suggest that plant survival and growth is highly dependent on the follow-up rains, the biology of the plants and their relative palatability. The grasses tended to grow most rapidly and herbage species such as tar vine, swainsona spp. and caltrop also grew quickly. Whilst the highly palatable umbrella grass responded to the rainfall, we measured a decrease in its height due to grazing.

The Effect of Fire on Ground Cover

The ground cover on all three sites increased over the duration of the study. Even though many seedlings died, the overall mass of larger plants and shrubs increased the overall ground cover. As expected, cover was highest on the unburnt site for the entire study and the cool burn site responded much better than the hot burn site. The rapid germination and growth of ground covering plants on the cool burn site shows that the seed bank was not destroyed by the fire.

The Effect of Fire on Resprouting

Species did resprout on both burnt sites, however, more resprouting occurred on the cool burn site. The species that showed basal resprouting included fork-leafed and long-leafed corkwood, acacia bush, broombush, witchetty bush and whitewood. The only woody species that did not resprout on the cool burn site was spiny saltbush (*Rhagodia spinescens*).

Unexpectedly, some of the shrubs and trees which had been badly burnt at the hot burn site showed signs of basal resprouting by the second site visit on 12/12/02. However, the whitewood trees that resprouted on the hot burn site seemed to be diseased and looked as though they were dying by the end of the study. An increased susceptibility to diseases and pests after fire has previously been noted by O'Reilly (2001).

The Effect of Fire on Flowering and Seeding

Plants on the cool burn site were not as scorched as those on the hot burn site and thus were able to recover, flower and set seed quicker. On the unburnt and cool burn sites, the grasses (oatgrass and 8-day grass) were found to have a fast life cycle. They quickly germinated, flowered and seeded before shriveling up and browning off. The final site visit on 26/2/03 showed that caltrop, tar vine and swainsona had all begun flowering on the unburnt and cool burn sites. No plants on the hot burn site produced flowers or seeds for the duration of the project. A harsher environment, caused by higher evaporation on the bare soil may have stopped the plants from getting enough moisture to grow to sexual maturity.

Conclusion

Plant regeneration occurred on both the burnt sites studied, with the main difference being the time taken for plants to regenerate and reproduce. As predicted, recovery was faster on the cool burn site compared to the hot burn site. Our second prediction, that badly burnt shrubs and trees on the hot burn site would not resprout was not supported.

Acknowledgments

The financial assistance and enthusiastic support of the Heaslip Family of Bond Springs is gratefully acknowledged. We would also like to thank Chris Tudor of St. Philips College, the Centralian Land Management Association, Bureau of Meteorology and Bushfires Council for assistance with this project.

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NEWSLETTER 03/3 CORRECTION

Some of you may have noticed the printing error in Appendix 1 from the article by Peter Russell and Wayne Fletcher in the November 2003 issue of the *Range Management Newsletter* (*RMN* 03/3 pages 7-8).

A corrected copy of the table will soon be available for downloading from the ARS website (www.austrangesoc.com .au).

OBITUARIES

RAYDEN ALFRED PERRY

Ray Perry AO who has died aged 78 was an inspirational leader in rangeland science in Australia and was held in the highest esteem by colleagues with whom he served on various international bodies and within the United Nations. Later in his career he straddled the divide between rangelands and agriculture, making an outstanding contribution as chief of the CSIRO Divisions of Land Resources Management and Groundwater Research. After retiring from CSIRO in 1986 he took up research in cultured pearl production, an industry as far removed as it could be from his earlier life.

Ray's introduction to his life's work followed his graduation from The University of Adelaide when he joined those early pioneers, Chris Christian and Allan Stewart, who had developed the land system approach to the field description of land resources. Land systems, post World War II, were a natural consequence of the new found ability to describe photo-patterns within aerial photography. Whole regions could for the first time then be interpreted using regional aerial photographic mapping. In the Barkly and Ord-Victoria surveys of the late 1940s and early 1950s the survey team bounced across the outback in open, ex-army Dodge weapon carriers, seated on municipal garden seats and describing with undoubted great difficulty geology, land forms, soils and vegetation. The brilliant reports, later compiled, were the templates for surveys throughout northern Australia and were essential for the planning of proper land use.

In 1956-7 Ray led the team which produced the monumental report on the Lands of the Alice Springs region finishing his field work with the Pasture Lands of the Northern Territory, a seminal work for Australia. Other jurisdictions followed the pattern set by these early workers adding degrees of sophistication made possible by data recorders and digital imaging but based fundamentally on land description.

In the late 1960s Ray led the Rangelands Research Unit in CSIRO and became responsible for directing the arid zone research programs at the Deniliquin and Alice Springs laboratories. Here many of the fundamental processes within the Australian rangelands were revealed for the first time. Under his leadership outstanding research was carried out by the highly talented teams that he was able to weld together.

Spending a year in the University of Arizona in 1960-61, and in 1967, Ray came into direct contact with the great corpus of work which characterises the approach of American scientists to the use of the rangelands. He formed great friendships with prominent Americans in the field such as Harold Heady of the University of California and Thad Box of Utah State University and there were many others whom Ray could count as friends. In so doing Ray opened up another window through which Australians could increase their perspective on rangeland land use. He invited David Carneggie to work in Western Australia in 1970 on the use of low level aerial colour and infrared photography in recording change in vegetation, in other words, monitoring. In 1972 he invited Thad Box to Australia to introduce us to concepts of recording change in vegetation. Many of the older generation will remember with great fondness and wonder the gathering at Alice Springs where rangeland workers from all over Australia worked together as teams for the first time coping with the, to some, arcane aspects of monitoring change in the field.

In the 1950s to the 1970s there was a great ferment within the bureaucracies as we grappled as a nation with the future of the rangelands, that three-quarters of Australia which is so sparsely populated and so resistant to accurate and repeatable measurement at even regional scale. Again the older amongst us will remember the Arid Zone Conferences held in Kalgoorlie, Alice Springs and other inland centres. Ray was in the forefront of organising the programs and setting the debates. What spirited meetings they were in the disciplinary as well as in the post-sessional sense. They have been replaced by the conferences of the Australian Rangeland Society, providing a necessary forum at which people with interests in the rangelands can gather together and freely debate the future of this land.

Ray was instrumental in establishing the US-Australia Rangeland Panel under the US/Australia Science and Technology Agreement. Invited scientists gathered together in successive years either in the USA or Australia to discuss plant morphogenesis and management (1971), herbivore impacts (1972), arid shrublands (1973), and rangeland evaluation (1974). The Australian Rangeland Society was conceived at the Alice Springs meeting in 1974 and born nine months later in Perth. Ray was a charter member of the Society and its President in 1983-84 when we took up the challenge at very short notice of running the 2nd International Rangeland Congress. Ray became the Chairman of the Organising Committee and backed its members with his encouragement and wisdom and with the capacity of the Division of Groundwater Research of which he was then the Chief.

As the Rangeland Society struggled to produce its first Journals and Newsletters it was Ray who provided the assistance of his staff and equipment to produce these publications. More importantly, our first conference was held at the Deniliquin laboratory when we grafted the meeting with Ray's permission onto an already planned scientific meeting of CSIRO scientists.

It is often fashionable today to decry rangeland science and, indeed, agriculture as too orientated towards production. Perhaps it is still so in some ways. However, Ray recognised that social and political questions were associated with land use change. He appointed a team of social and political scientists to the Division of Land Resources Management to provide another view of mans' relationship with the land. Perhaps for many it was the beginning of their understanding of inter-generational equity. In another sense of an awareness of alternatives Ray was convinced of the great future for tourism in the Northern Territory. At a time when cattle was "king" in the 1950s and 1960s this prophetic vision was mocked (see Matthew 13 v57).

Following his retirement in 1986 Ray undertook the task of organising research into the cultured pearl industry. His early interest was into the causes of failure in nacre development around the irritants inserted into the pearl shell. Great bags of deformed pearls were strewn about his house at City Beach where he and Del lived.

Ray was appointed an Officer of the Order of Australia in the Queen's Birthday Honours list of 1991 for his services to science and to the environment. He was a Foundation Fellow of the Australian Academy of Technological Sciences and Engineering and was at the forefront at the formation of the Ecological Society of Australia. He was awarded the Centenary Medal in 2003.

Ray is survived by his wife Del, and his daughters Tracey and Kirsten, and two granddaughters, all of whom he dearly loved.

D G Wilcox AM
President ARS

CHARLES WILLIAM EDWIN MOORE

The death occurred in Canberra on *27 October 2003* of C.W.E. (Ted) Moore, aged 95 years. During his working lifetime he made significant contributions to ecological and botanical knowledge of south-eastern Australia at a time when ecologists were few and far between. Of particular note was Moore's pioneering research into the ecology of "woody weeds" in pastoral lands and his promotion of prescribed burning for vegetation management in semi-arid Australia. His initial work on "woody weeds" conducted in the last decade of his working life influenced others from CSIRO and State Departments to continue research to address this widespread and worsening problem following his retirement from CSIRO in 1973.

Born in Dunedin in the South Island of New Zealand, Moore later attended Lincoln College, near Christchurch, where he obtained his B. Agr. Sc. degree in 1933. Given the lack of employment opportunities in New Zealand at the time due to the Great Depression, he immigrated to Australia in 1935 eventually settling in Canberra teaching science at Canberra Grammar School. He later joined the CSIR Division of Plant Industry in the early 1940's where

he worked as a Technical Officer on alternative plant sources of latex for rubber during World War II. He then began researching floristic changes in vegetation following disturbance, especially by grazing. His most significant project involved the first regional-scale study of the original native vegetation communities of the eastern Riverina. The results of this definitive study were subsequently published in 1953 in the first volume of the *Australian Journal of Botany* and the two papers still continue to be cited by regional ecologists. For this research he was promoted to Research Officer and earned an M. Sc. degree from the Australian National University. Not only was he widely acknowledged as a highly competent field ecologist, many of his numerous research papers also reflected the specialised skills required when conducting detailed glasshouse and laboratory experiments.

In the mid 1960s, following approaches to CSIRO by various branches of the NSW Graziers' Association, especially the Louth branch on the Darling River, Moore was delegated by CSIRO to visit areas within the Western Division of New South Wales to determine whether the organisation should set up a research program into the problem of native shrub proliferation in the semi-arid woodlands. After his report had confirmed the seriousness and scale of the problem, he was authorised to initiate appropriate investigations. Moore clearly recognised that the development of sound management practices for effective shrub control depended almost entirely on gaining an understanding of the key ecological processes involved. In 1966, with funds provided by the Wool Research Trust Fund, he established research plots on "Tundulya" Station owned then by Les and Pat Le Lievre and "Mount Mulyah" Station owned by Peter and Mary Bryant - both stations lying north-west of Cobar. Here he conducted various experiments over the next seven years. Most studies were directed towards evaluating the relative importance of domestic stock, rabbits, fire and soil erosion, as well as their interactions, in the development and management of shrub increase.

Three years later in September 1969, Moore's life took another turn with his appointment as Officer-in-Charge of the CSIRO Riverina Laboratory at Deniliquin, New South Wales. As leader of the research group at the laboratory, he played a significant role in changing the research emphasis of scientists in the Laboratory from management of irrigated agriculture enterprises to ecological studies of the semi-arid rangelands. He continued to maintain his own research interests at "Tundulya" and "Mount Mulyah" while still influencing others researching the problem of "woody weeds" until he and his family returned to Canberra in April 1973 prior to his retirement.

Although quiet and unassuming in manner, he possessed a keen sense of humour. A conscientious and equitable administrator, he was scrupulous in his scientific approach and was highly respected by all those fortunate enough to have worked with him at Deniliquin during his period as research leader and Officer-in-Charge.

Following retirement, he was able to indulge his long-abiding interests in botany and plant taxonomy for more than 20 years as an Honorary Research Fellow with CSIRO at the then *Herbarium Australiense* before it later became the *National Herbarium*. In recognition of his many scientific contributions, he had several plant species named after him including, appropriately enough in the context of Australian rangelands, *Convolvulus tedmoorei*, the type specimen having been collected by him in 1971 on the floodplain of the Darling River a few kilometres west of Louth.

Ted Moore was predeceased by his wife Dorothy but is survived by his son Michael and daughter Robin.

Jim Noble

CSIRO rangeland research staff pictured at the Riverina Laboratory at Deniliquin in 1972 during a program meeting. Ted Moore can be seen in the middle of the photograph (glasses, open-necked shirt and sports coat) while Ray Perry is also standing nearby (8th from the left).

LAKE EYRE BASIN AGREEMENT - OVERVIEW OF PROGRESS

Vol Norris, Facilitator, Lake Eyre Basin Ministerial Forum Community Advisory Committee, PO Box 519, Longreach QLD 4730.
Temporary email: robynandvol@bigpond.com

Following debate in the 1990's over potential world heritage listing of the Lake Eyre Basin and proposals for major water resource development in the eastern basin, the Australian, Queensland and South Australian Governments signed the Lake Eyre Basin Agreement in October 2000 to ensure the future sustainability of the basin river systems. The Northern Territory Government is considering its potential involvement in the Agreement.

The Agreement provides for the development, adoption and implementation of policies and strategies concerning water and related natural resources in the Agreement area, to avoid or eliminate cross-border impacts, and to ensure sustainability of the multiple values of the basin. Responsibility for policy and strategy development rests with the Lake Eyre Basin Ministerial Forum, which receives advice through the Community Advisory Committee and the Scientific Advisory Panel.

The Ministerial Forum adopted five policies in October 2002 concerning river flows, water quality, water and related natural resources, existing entitlements/water resource development, and research and monitoring. Policies focus on protecting and maintaining the ecological integrity and natural function of in-stream and floodplain ecosystems, together with the viability of economic, social, and cultural activities that do not threaten these environmental values.

LEB Community Advisory Committee

The roles of the Community Advisory Committee, which was reconstituted in October 2003, are:

- to provide community advice, representation and feedback to the Ministerial Forum on water and related natural resource issues in the basin;
- to seek out community views on matters relevant to the Lake Eyre Basin Agreement; and
- to communicate the decisions and initiatives of the Ministerial Forum to the Lake Eyre Basin community.

Members of the CAC must represent Aboriginal, pastoral, agricultural, mining, petroleum, conservation and tourism interests, as well as interests related to the Cooper Creek and Georgina-Diamantina River Systems.

The CAC met in Longreach on 21st November 2003 (see Photo 1), and in Adelaide on 4th and 5th February 2004. Issues discussed at these meetings included:

- recent calls in the upper basin for a review of the moratorium on water diversions in the Cooper's Creek catchment;
- the Georgina-Diamantina Draft Water Management Plan;
- petroleum exploration in the basin; and
- strategies for facilitating Aboriginal involvement in the Lake Eyre Basin management process.

Minutes, work plans and activities of the Community Advisory Committee will made be available on its web site, currently under development. The Lake Eyre Basin Agreement can be viewed at:
www.deh.gov.au/water/basins.lake-eyre/agreement.html.

To obtain further information on the Lake Eyre Basin Community Advisory Committee, its meetings and recommendations to the Ministerial Forum, contact the Chair, Mr Angus Emmott, on 07 4658 5953 or the Facilitator, Mr Vol Norris, on 07 4658 4435.

Photo 1. Lake Eyre Basin Community Advisory Committee meeting in Longreach, 21st November 2003. Clockwise from the rear left: Mick Roche (Qld), Joslin Eatts (Qld), Paul Woodland (SA), Rob Palmer (SA) (in place of Declan Andrews), George Cooley (SA), Angus Emmott (Qld) (Chair), Lesley Marshall (Qld), Vol Norris (Facilitator), David Brook (SA), Peter Douglas (Qld), Lynn Brake (SA), Maree Morton (SA), Denis Kenny (Qld). Absent from photo: Declan Andrews, Sharon Oldfield.

REPORT FROM COUNCIL

Lachlan Pegler, Communications Officer ARS, 34A Bridge St., Toowoomba QLD 4350.
Email: lgha@growzone.com.au.

The activities of Council in the past few months have been in the nature of consolidation and refinement, rather than the pursuit of any new major initiatives. Some of the main issues from Council teleconferences were:

- Some ongoing discussions regarding the future of the society and the ways to attract and retain membership have been reinvigorated with valuable input from Neil MacLeod on the operation of other professional societies of similar persuasion. The idea of symposia in conjunction with the conferences or other events has been aired, and Council would be very interested to speak with any members who have ideas for symposia on current issues or wish to organise similar events under the auspices of the Society.
- The transition of the financial operations from the long serving treasurer John Maconochie, to the capable hands of Tim Ferraro is progressing smoothly, with some valuable assistance from Don Blesing in regard to issues of efficiency, reporting and accountability to Council.
- The development of a new logo for the society is slowly progressing, with a graphic artist engaged to provide a range of alternative interpretations of the Society's image, following a brief from the members of Council.
- Robyn Cowley has resigned form her position on Council, due to personal and professional workloads. The Council is very grateful for the valuable contributions and passion Robyn bought to the Council. She will be sorely missed.
- The planning for the 13th Biennial Conference in Alice Springs is progressing well, with Robyn Cowley remaining as the representative from Council on the organisation committee.
- David Wilcox has been active in keeping the website current, but would really appreciate the services of any member who could act as Web Master to assist in the maintenance of the site (I'm sure it would look good on any CV!).
- Ian Watson, the Subscription Manager, has been busy effecting an improvement in the efficiency of the current Society database, particularly in regard to new privacy legislation. He is also seeking to identify historical and legal reasons for all complementary memberships of the Society.

The only other significant news is that I have left Charleville and now have a private business in (much cooler) Toowoomba, but I hope to keep my involvement with the Society into the future.

AUSTRALIAN RANGELAND SOCIETY AWARDS

The Society has two awards to assist members with either:

- Studies related to the rangelands, or
- With travel expenses associated with attending a conference (or some other activity).

Applications for each award close in June of each year. Any member of the Society interested in either award is invited to apply. Students are particularly encouraged to apply to assist their attendance at the 2004 ARS Conference in Alice Springs.

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 has the purpose of 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 grant 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 Council before 30th June. Application forms and guidelines can be downloaded from the ARS website at http://www.austrangesoc.com.au. Those requiring further information should contact the ARS Secretary, Sandra Van Vreeswyk, at svanvreeswyk@agric.wa.gov.au or Ph (08) 9368 3917.

Conditions

Applications for the Travel Grant should include details of the costs and describe how the grant is to be spent. Details of any other sources of funding should be given. Those applying for the Scholarship should include details of the program of study or course being undertaken and the institution under whose auspices it will be conducted. Information on how the scholarship money will be spent is required, as are details on any other sources of funding.

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

Finally, on completing the travel or study, recipients are required to fully acquit their grant or scholarship. They are also expected to write an article on their activities or experiences for the *Range Management Newsletter.*

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.

Travel or study assistance can be made available to a non-member where Council considers that the application meets the aims of the Society, and is of sufficient merit.

Overseas Travel and Study

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 grants can be for Australian members travelling overseas or overseas members to for study within Australia.

SPECIAL ISSUE OF THE RANGELAND JOURNAL –

A Special Issue of the Rangeland Journal (Volume 25 (2)), entitled *Drivers of Change in the Rangelands*, was recently published. This volume examines many of the issues discussed at the 12th Biennial Conference of the Australian Rangeland Society which was held in Kalgoorlie, Western Australia in September 2002. Volume 25 (2) includes a guest editorial by Leigh Hunt; an Introduction by His Excellency Lieutenant General John Sanderson AC, the Governor of Western Australia; and expanded versions of many of the keynote papers presented at the conference.

The titles of the individual papers presented in this volume are included below:

Pastoralism in tropical rangelands: seizing the opportunity to change – Andrew Ash and Mark Stafford Smith

Global influences on rangelands of Australia – G.A. Robertson

The economy of Australian rangelands: myth or mystery – J.D. Fargher, B.M. Howard, D.G. Burnside and M.H. Andrew

Conservation and the maintenance of biodiversity in the rangelands – J.C.Z. Woinarski and A. Fisher

Are miners the bunnies or the bilbies of the rangelands – J.L. Read

Opportunities for the future in Australia's grazed rangelands – L.P. Hunt

FUTURE THEMES FOR THE RANGE MANAGEMENT NEWSLETTER

I am always interested in hearing from members about possible themes for future issues of the *Range Management Newsletter*. The theme can be anything broadly related to the Society – for example previous issues have included articles from Australian members working on rangeland projects overseas (*RMN* 02/3 – November 2003) and also a series of monitoring summaries (RMN 03/1 – March 2003)

If you have any bright ideas please email me at nduckett@oz email.com.au.

ARS WEB MASTER REQUIRED

Are you looking for a place to demonstrate your skills in the area of web site design and maintenance?

If so, the ARS Council would be very keen to hear from you.

The Society is currently looking for someone who would be interested in volunteering as Webmaster for the new ARS website which can be found at www.austrangesoc.com.au.

Please contact the President, David Wilcox, at dgwil cox@cygnus.uwa.edu.au if you are interested.

Yes, its time to consider registering for the next ARS conference.

13th BIENNIAL CONFERENCE
5 - 8 JULY 2004

Yes, it's in July this year, in Alice Springs, and coinciding with a very festive time in the region. Immediately prior to the Conference is the Alice Springs Show weekend, with all the attractions of a traditional country show. The weekend following the Conference sees the running of the famous "Camel Cup". Of course, there are also unlimited scenic attractions to explore in the Alice Springs region and we hope you will take some time to experience our magnificent part of the world.

The registration brochure will be sent out very soon, to those that have already registered their interest in attending. If you haven't received a brochure, you will be able to download it from the web site on www.austrangesoc.com.au.

However, if you would like more information, here is some to whet *(that's not WET for those of us who still need rain)* your appetite.

CONFERENCE VENUE

Minnamurra Hall, St. Philip's College, Schwarz Crescent, Alice Springs NT 0871

SOCIAL FUNCTIONS (important things first)

Registration and Mayoral Reception, Minnimurra Hall, St Philips College
Sunday 4 July, 5pm – 8.30pm. (*This function is included in Registration fees.*)
Informal BBQ Dinner, the Alice Springs Golf Club
Monday 5 July, 6.30pm for 7.00pm *(Please note the BBQ is NOT included in registration fees)*
Conference Dinner, Ooraminna Homestead and Bush Camp
Tuesday 6 July, 5.00pm (*Dinner is included in delegate's Registration fees)*

CONFERENCE REGISTRATION

ARS MEMBERS REGISTRATION	**$480.00**
Discounted registration fee to members of the Australian Rangeland Society.	
EARLYBIRD CONFERENCE REGISTRATION	**$512.00**
Earlybird discount closes 16 April 2004.	
FULL CONFERENCE REGISTRATION	**$540.00**
(From 17 April 2004)	
DAY REGISTRATION	**$200.00**
STUDENTS & LAND MANAGERS	**$270.00**

Please note that this is a separate offer to ones being given to students and land manager, presenting papers at the Conference, and who have been awarded sponsorship of full registration fees.

GENERAL INFORMATION

The average maximum temperature in Alice Springs in July is 20^{0}C; the minimum is approximately 5^{0}C but frosts do occur. We recommend warm clothing for outdoor activities – especially the Conference Dinner.

See you there!

INFORMATION SNIPPETS

2004 Eureka Prizes

Recent press releases from the Australian Museum report that a record $220,000 will be awarded to outstanding Australian science in the 2004 Australian Museum Eureka Prizes, Australia's premier science awards. The 2004 series consists of an unprecedented 22 prizes rewarding outstanding Australian science, research, industry, innovation, education and science communication - including a record number of prizes for research into environmental and sustainability issues facing Australia.

Two exciting new prizes have been launched in 2004. The $10,000 Holmes à Court Eureka Prize for Science Teaching is for a secondary science teacher with a proven capacity to inspire students to pursue curiosity-driven learning in science. Sponsored by Peter and Divonne Holmes à Court, this new prize compliments the three existing Eureka student prizes. The $10,000 Land and Water Australia Eureka Prize for Water Research is for highly innovative research that has made or has the potential to make an outstanding contribution to the protection, sustainable use and management of Australia's water resources and water-dependent ecosystems.

2004 also sees significant changes in the scope of three long-running prizes. The $10,000 Reed New Holland Eureka Science Book Prize becomes a prize for an unpublished manuscript or book proposal, rather than for a published work. The winning author receives $10,000 PLUS a contract with Reed New Holland for publication of their winning manuscript or book proposal.

The promotion of science prize, one of the three original Eureka Prizes launched in 1990, becomes the Australian Government Eureka Prize for Promoting Understanding of Science. The prize is sponsored by the Hon. Peter McGauran MP, the Federal Minister for Science through the Department of Education, Science and Training. It rewards individuals or groups for outstanding works of science communication that promote interest and enthusiasm about science in the general community AND enhance the public's ability to assimilate public information on scientific issues in an informed and accurate manner.

The Australian Government Eureka Prize for Science Journalism, also sponsored by the Federal Minister for Science, will now consider entries based on a "body of work" over the past year as well as individual stories.

Candidates for Eureka Prizes can enter themselves or be nominated by others. Details and entry forms for this year's are available from the Australian Museum's website at www.amonline.net.au/eureka Entries in most prizes close Friday 14 May 2004, with winners announced at a gala award dinner at Sydney's famous Hordern Pavilion on 10 August 2004.

AW Howard Memorial Trust Fellowship

The A W Howard Memorial Trust Incorporated seeks applications from suitably qualified students in agricultural science, natural resource management, agricultural economics and social science who are intending to commence or have started approved post-graduate tertiary studies (Masters or Doctorate degrees) that relate to the development, management and use of pastures.

The A W Howard Memorial Fellowship will be awarded on a competitive basis and will provide an annual $5000 "top up" postgraduate stipend to the successful applicant tenable for a period of up to 3 years. The successful student will be recognised as the "A W Howard Fellow".

Further information and links to the application form are available from the following website: http://www.sardi.sa.gov.au/pages/key_links/awhoward_fellowship.htm. Note that applications for this year close on Friday 26 March 2004 and that applications must be accompanied by 2 letters of support, these from the research supervisor and an appropriate senior representative of a University or research agency.

New Report Helps in Identifying Naturalised Plants that Pose Risk

Weed Categories for Natural and Agricultural Ecosystem Management, a new report published by the Bureau of Rural Sciences, draws together information on thousands of non-native plants that have become established or `naturalised' in Australia. The book aims to categorise the approximately 2700 non-native naturalised plants into groups of major and minor threats to natural ecosystems and agricultural environments.

The report is available in PDF fomat from the Department of Agriculture, Fisheries and Forestry website (http://www.daff.gov.au/brsweeds - see under 'hot topics'). Hard copies of the book are also available for $20 by phoning 1800 020 157.

New Soils Book to be Released

A new soils book entitled *Australian Soils and Landscapes: An Illustrated Compendium* is due to be released by CSIRO Publishing in April 2004. This book, written by Neil McKenzie, David Jacquier, Ray Isbell (deceased) and Katharine Brown, provides an introduction to the soils and landscapes of Australia. It reveals their great diversity and explains why a soil's basic properties and position in the landscape should guide our use of the land.

The compendium describes and illustrates over 100 of the more important and widespread soils of Australia. It also includes a brief account of each soil's environment, usage and qualities as well as information on chemical and physical properties.

CSIRO Publishing indicates that the book will be appropriate for a wide range of users including: land managers and farm advisers; land resource assessment agencies; professionals and researchers in forestry, agronomy, hydrology, ecology and planning; soil scientists; and soil testing laboratories in universities and government agencies.

The book will sell for $110 and can be ordered directly from CSIRO Publishing at www.publish.csiro.au.

Linking indigenous people with mining

Late last year the Australian Bureau of Agricultural Resource Economics (ABARE) published a report, and a shorter key findings article, entitled *Indigenous People in Mining.* In this study, authored by Tedesco, Fainstein and Hogan, mine sites in Australia were surveyed to collect information on indigenous employment and other economic linkages between mine sites and indigenous communities.

The study, commissioned by the Federal Department of Industry, Tourism and Resources will use the information collected through the survey to assist future initiatives under the mining industry indigenous communities regional partnership program, known as the 'Working in PartnershipProgram'.

Both the full report and the key findings article are downloadable from the ABARE website (http://abareonlineshop.com).

NEW MEMBERS

Peter Jessop
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PMB 227
Umuwa Via Alice Springs NT 0872

Brett and Linda Crook
Edjudina Station
PO Box 292
Kalgoorlie WA 6430

Sylvia Clarke
Environmental Biology (SEES)
University of Adelaide
Darling Building, North Terrace
Adelaide SA 5005

Edith Cowan University – Serials Acquisition
Joondalup Campus Library – Level 2
100 Joondalup Drive
Joondalup WA 6027
Pastoral Lands Board of WA
c/o Brian Lloyd
Pastoral Lands Board, DPI
PO Box 1575
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Queensland Herbarium
Mt Coot-tha Road
Toowong QLD 4066

FINANCE AND AUDIT OFFICER'S REPORT

Tim Ferraro, Executive Officer, WEST 2000 Plus, PO Box 1840, Dubbo NSW 2830.
Email: tim.ferraro@dipnr.nsw.gov.au

For a range of reasons, the Society's financial statements for 2000, 2001 and 2002 have not been published in the Range Management Newsletter. The following pages contain extracts from the audited financial statements and summarise financial performance, financial position and cash flows for 2000, 2001 and 2002.

The financial statements have been produced by Lee Green and Company Pty Ltd and are in accordance with Australian auditing standards. Complete copies of the financial statements can be obtained by contacting the author.

The 2003 financial statements will be available following auditing and presentation to the Annual General Meeting. Please note that Society's financial year is the calendar year.

Financial position

Owing to the impact of the biennial conference, the Society's financial position tends to fluctuate substantially approximately every two years. An operating loss from ordinary activities of $16,033 was recorded in 2000, a profit of $40,952 in 2001 and a loss of $1,138 in 2002. The total equity of the Society has risen from $72,658 in 2000 to $112,472 in 2002. While there was a 1% drop in equity from 2001 to 2002, total equity is now 35% higher than it was in 1999. This is a pleasing result.

Revenues over the three years have substantially increased from a base of $38,219 in 2000 to $66,349 in 2001 and $83,481 in 2002. Conferences continue to be well run and provided the Society with a financial injection of $16,717 in 2001 and $51,662 in 2002. The profit from conferences is a pleasing result, but Council is concerned that this revenue is not necessarily guaranteed and is again looking at options to ensure the income of the Society is generated from a more stable and regular base. Naturally, this means trying to generate additional subscriptions.

Subscriptions

Membership fees have fluctuated over the three years from $34,265 in 2000 to $43,152 in 2001 before dropping to $26,052 in 2002. While membership numbers appear to be reasonably stable, there is a need to ensure that revenue from membership fees forms a regular income stream and that these fees cover the major operating expenses of the society.

Journal and Newsletter

The Journal and Newsletter continue to be major expenses for the Society. An investigation by the Council and Malcolm Howes have reduced the per-issue production cost for the Journal by around one-third.

Investments

The Society earned interest of $3,954 in 2000, $1,490 in 2001 and $3,261 in 2002. A number of bank accounts have been consolidated to enable better funds management, reduce compliance costs and decrease bank fees. Council is currently investigating options for investing funds not required for normal operating costs.

Purchases

No significant capital purchases were made in the three years.

Looking forward

The Society has moved forward on a number of compliance and funds management issues. A new computerised accounting system is being used and this will enable better management of members funds and easier reporting to the ATO and ASIC. Operating costs have been reviewed and substantially reduced in some cases. At the end of 2002, the Society was running a reasonable cash surplus and, as noted above, has options to invest surplus funds to generate interest income. The perennial issue of membership numbers being sufficient enough to sustain the Society in the long term remains, and the Council is currently looking at this issue.

FINANCIAL REPORTS FOR THE YEAR ENDED 31ST DECEMBER 2000

Statement of Financial Performance

CLASSIFICATION OF EXPENSES BY NATURE	2000 ($)	1999 ($)
Revenues from ordinary activities	38,219	36,891
Depreciation expense	-	(1,687)
Journal Costs	(20,451)	(19,707)
Conference Costs	(5,485)	(5,009)
Newsletter Costs	(12,989)	(642)
Other expenses	(15,327)	(21,984)
Loss from ordinary activities	(16,033)	(12,138)

Statement of Financial Position

	2000 ($)	1999 ($)
CURRENT ASSETS		
Cash Assets	74,412	97,381
TOTAL CURRENT ASSETS	74,412	97,381
NON-CURRENT ASSETS		
Property, plant and equipment	-	2,531
TOTAL NON-CURRENT ASSETS	-	2,531
TOTAL ASSETS	74,412	99,912
CURRENT LIABILITIES		
Payables	1,754	11,221
TOTAL CURRENT LIABILITIES	1,754	11,221
NET ASSETS	72,658	88,691
EQUITY		
Retained profits	72,658	88,691
TOTAL EQUITY	72,658	88,691

Statement of Cash Flows

	2000 ($)	1999 ($)
CASH FLOW FROM OPERATING ACTIVITIES		
Receipts from members and others	34,265	33,352
Interest received	3,954	3,539
Payments to suppliers	(61,188)	(47,406)
Net Cash used in operating activities	(22,969)	(10,515)
Net Decrease in Cash held	(22,969)	(10,515)
Cash at Beginning of the year	97,381	107,896
Cash at End of the year	74,412	97,381

FINANCIAL REPORTS FOR THE YEAR ENDED 31ST DECEMBER 2001

Statement of Financial Performance

CLASSIFICATION OF EXPENSES BY NATURE	2001 ($)	2000 ($)
Revenues from ordinary activities	66,349	38,219
Depreciation expense	-	-
Journal Costs	(12,103)	(20,451)
Conference Costs	(6,508)	(5,485)
Newsletter Costs	(1,956)	(12,989)
Other expenses	(4,830)	(15,327)
Profit/(Loss) from ordinary activities	40,952	(16,033)

Statement of Financial Position

	2001 ($)	2000 ($)
CURRENT ASSETS		
Cash Assets	109,873	74,412
Other Receivable - GST	3,737	-
TOTAL CURRENT ASSETS	113,610	74,412
NON-CURRENT ASSETS		
Property, plant and equipment	-	-
TOTAL NON-CURRENT ASSETS	-	-
TOTAL ASSETS	113,610	74,412
CURRENT LIABILITIES		
Payables	-	1,754
TOTAL CURRENT LIABILITIES	-	1,754
NET ASSETS	113,610	72,658
EQUITY		
Retained profits	113,610	72,658
TOTAL EQUITY	113,610	72,658

Statement of Cash Flows

	2001 ($)	2000 ($)
CASH FLOW FROM OPERATING ACTIVITIES		
Receipts from members and others	64,859	34,265
Interest received	1,490	3,954
Payments to suppliers	(30,888)	(61,188)
Net Cash used in operating activities	35,461	(22,969)
Net Decrease in Cash held	35,461	(22,969)
Cash at Beginning of the year	74,412	97,381
Cash at End of the year	109,873	74,412

FINANCIAL REPORTS FOR THE YEAR ENDED 31ST DECEMBER 2002

Statement of Financial Performance

CLASSIFICATION OF EXPENSES BY NATURE	2002 ($)	2001 ($)
Revenues from ordinary activities	83,481	66,349
Journal Costs	(27,181)	(12,103)
Conference Costs	(41,314)	(6,508)
Newsletter Costs	(5,860)	(1,956)
Other expenses	(10,264)	(4,830)
(Loss)/Profit from ordinary activities	(1,138)	40,952

Statement of Financial Position

	2002 ($)	2001 ($)
CURRENT ASSETS		
Cash Assets	119,797	109,873
Other Receivable - GST	-	3,737
TOTAL CURRENT ASSETS	119,797	113,610
TOTAL ASSETS	119,797	113,610
CURRENT LIABILITIES		
Payables	7,325	-
TOTAL CURRENT LIABILITIES	7,325	-
NET ASSETS	112,472	113,610
EQUITY		
Retained profits	112,472	113,610
TOTAL EQUITY	112,472	113,610

Statement of Cash Flows

	2002 ($)	2001 ($)
CASH FLOW FROM OPERATING ACTIVITIES		
Receipts from members and others	80,220	64,859
Interest received	3,261	1,490
Payments to suppliers	(73,557)	(30,888)
Net Cash generated from operating activities	9,924	35,461
Net Increase in Cash held	9,924	35,461
Cash at Beginning of the year	109,873	74,412
Cash at End of the year	119,797	109,873

MEMBERSHIP APPLICATION FORM

The Australian Rangeland Society

TAX INVOICE / RECEIPT ABN 43 008 784 414

Please complete and return to the Subscription Manager, Ian Watson, PO Box 483, NORTHAM WA 6401
Ph (618) or (08) 9690 2179: Fax (618) or (08) 9622 1902: iwatson@agric.wa.gov.au

I, [name] .....

of [address] .....

.....

Postcode..... Email address .....

Phone ..... Fax .....

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/institution* for the calendar year 2004.

(* delete as appropriate)

❑ Charge my Mastercard VISA Bankcard AU$.....for full/part* membership for an individual/ student/institution* for the calendar year 2004

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:	**Australia**	**Overseas Airmail**
Individual or Family -		
Full (Journal + Newsletter)/Student	$80.00/$60.00	$100.00/$80.00
Part (Newsletter only)/Student	$45.00/$30.00	$55.00/$35.00
Institution or Company -		
Full (Journal + Newsletter)	$110.00	$135.00
Part (Newsletter only)	$60.00	$70.00

- 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.