



The Australian Rangeland Society

RANGE MANAGEMENT NEWSLETTER

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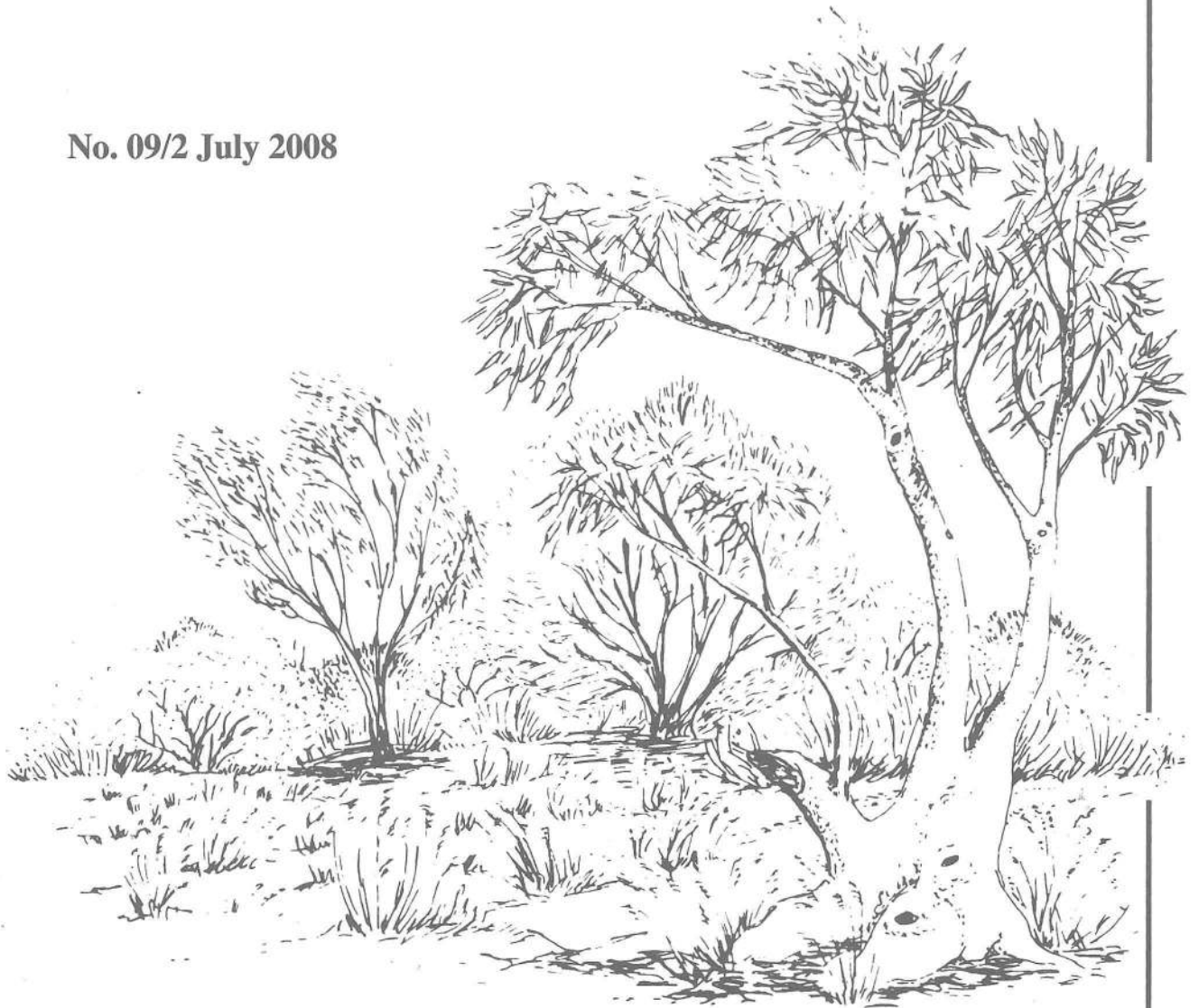
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FROM THE EDITOR

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Welcome to the mid-year edition of the *Range Management Newsletter*.

This issue opens with further information about the Australian Rangeland Society's upcoming Biennial Conference. It will take place in Charters Towers in a little over a month, and promises to be an excellent event. The number of registrations is looking pretty good so far - 175 people have taken advantage of the early registration including 95 ARS members, 61 non-members and 16 full-time students. Several people have also registered for parts of the conference or as accompanying people. Don't forget to register soon to secure your place!

A major part this issue is devoted to reports from the recent VIII International Rangeland Congress and XXI International Grassland Congress which was held in Hohhot, China in late June/early July. Firstly, Don Burnside has provided some excellent observations about the Congress from both a 'professional' and 'personal' viewpoint. Don highlights discussions about monitoring, climate change, and the use and management of rangelands in so-called developing countries. He also adds some less-serious highlights and even manages to make the Mongolian throat-singing sound like a must-see event! Following on from Don's report, I have been lucky enough to obtain the three Theme summary reports that were presented on the final day of the Congress by Andrew Ash (Theme A - Grasslands/Rangelands Resources and Ecology), Scott Laidlaw (Theme B - Grasslands/Rangelands Production Systems) and Ann Waters-Bayer (Theme C - Grasslands/Rangelands People and Policies). These authors worked very hard to get their reports to me in time for publication, and they provide an excellent overview of the Congress papers, posters and discussions.

Next, Wal Whalley has submitted an excellent, comprehensive review of the recently released book entitled *Carbon Sequestration in Tropical Grassland Ecosystems* edited by L. 't Mannetje, M.C. Amézquita, P. Buurman and M.A Ibrahim. Wal describes this book as "required reading for anyone seriously interested in land management and carbon sequestration." It is obviously a book that questions popular beliefs - Wal points out that some of the findings are "somewhat contrary to conventional wisdom." Read Wal's review to see what you think!

This issue concludes with a number of articles related more directly to the Society including the Directors' report tabled at the AGM held in May 2008 and a list of new members. There is also information pertaining to the ARS Awards which close in **November**.

The next issue of the newsletter is due out in November 2008. Please have any articles to me by the end of September.

AN UPDATE ON THE 15TH ARS BIENNIAL CONFERENCE

Registration is now underway for the 15th Biennial Conference of the Australian Rangeland Society which will be held in Charters Towers in Queensland, from 28 September - 2 October, 2008. The theme for the Conference is "A climate of change in Australian Rangelands."

The Conference will comprise one-day field visits followed by two and a half days of research presentations and discussions. It will take place at the World Theatre in Charters Towers. This is centrally located and an ideal venue for spoken sessions with poster displays located in the adjacent Arthur Titley Centre. An exciting social program has also been developed to ensure delegates have a "Charters Towers" experience.

The research presentations have been grouped into five sessions:

1. Grazing management, land condition and monitoring in the rangelands;
2. Biodiversity management and conservation in rangelands;
3. Capacity building and social issues in rangelands;
4. Multiple use and restoration in rangelands; and
5. Research and development in rangelands.

The program will also include a focus on Youth in the Rangelands with a youth forum and four of the oral presentations in a dedicated Student Session

For more details about the conference program, the field trips and the social events please visit the conference website at austrangesoc.com.au.

This is an important event that you won't want to miss! Registration is easy - do it on-line through the ARS website!!

REPORTS FROM THE VIII INTERNATIONAL RANGELAND CONGRESS

Overview

The XXI International Grassland Congress and VIII International Rangeland Congress were held as a joint meeting in Hohhot, China from 29 June – 5 July 2008. By all accounts, it was a success!!

A number of reports from the Congress have been included here. First is a report from Congress attendee Don Burnside. Following this are the reports of the three theme summaries given on the final day of the Congress.

Some Personal Observations from a Congress Attendee

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This first combined IRC/IGC event resulted from a convergence of events over several years through which the Chinese Grassland Society successfully argued the case for such a joint meeting in 2008. Organisation involved both the IRC and IGC and was reportedly not without its difficulties. However, the Congress ran well, and was attended by about 1,500 delegates, nearly 660 of who were Chinese nationals. Australia had the largest international delegation with 132 registrants.

Overall there were 77 countries represented, which gave it more of an international flavour than past Congresses I have attended. This was a welcome development in terms of the content of much of the discussion at the Congress, which focused less on the finer points of 'developed world' rangeland management in countries such as Australia and the USA, and more on urgent problems in 'life in the raw' rangeland management in Asia and Africa. More about that below.

The context

Hohhot is a city of about 2.5 million, and is the capital of the Inner Mongolian Autonomous Region of China. Despite its proximity to Mongolia, about 88 per cent of the people are Han Chinese, with 12 per cent being of Mongolian origin. However, pride in the Mongolian heritage is high, with a magnificent statue of Genghis Khan astride a horse in the middle of the city, a superb Mongolian dance and singing company, and many quality Mongolian restaurants. It was a cultural feast.

The Chinese context for the Congress is the obvious rapid expansion of the Chinese economy *albeit* with strong government direction, the enthusiasm for the Olympics, pride in history and culture, a palpable sense of confidence and excitement about the future amongst the young people we met, rapid migration of people from poorer rural areas into the cities, and increasing standards of living

throughout. People who had visited Hohhot just three years previously said that large changes had occurred in that time, and there are lot of fine new buildings. Finally, the hospitality at all times was great, we were made to feel very welcome, and the beer is great!

Rangeland science and practice – what progress is being made?

My brief review of the posters and papers suggested that people everywhere are operating within a dis-equilibrium model of rangeland function, but how the challenges posed by this model can be handled in practice was less evident.

At the same time, several papers emphasised increasing rangeland intensification, and increasing policy and management complexities – as in managing for multiple objectives. Andrew Ash in his summary presentation highlighted that the rate of change in rangelands is outstripping the rate at which we learn to adapt to these changes. We do need new science, that is targeted at major problems, and that will inform policy makers.

In many papers and posters, particularly those from Asia, there was a push for technology developments in terms of improved plant and animal genetics, better grazing systems that involve more infrastructure, and better marketing and product development. The extent to which these technologies can be adopted and the overall benefits that they will deliver at systems scale was less well addressed.

That 'hoary old chestnut' rangeland monitoring got a reasonable run, with a push from the USA for the development of global environmental and socio-economic indicators of rangeland change. However, the quality of the presentations suggested that there is a way to go. The challenge is to incorporate social and economic indicators into the systems. However, as in any monitoring system, increasing the number of dimensions that we are measuring reduces the capacity to make easy use of the data and information. Finally, as one of the Australian contingent suggested – 'instead of talking about how and why to do monitoring, why don't they just get on and do it?' As usual, some presenters complained that there was insufficient political will, and hence dollars to do it. Why is this still an issue?

There were a number of sound plenary presentations calling for increased integration across bio-physical, economic and social disciplines, but little advice about how this could be achieved, and even some suggestion that it was a new idea! It was ironic therefore that the three major themes of *Resources and Ecology*, *Production Systems*, and *People and Policies* were separate. Further, there were not many papers or posters that demonstrated strongly integrated science, with a high proportion of them being contributed by Australians. My feeling is that we are further advanced in integrating the disciplines in Australia than in other parts of the world, and there was compelling evidence in Ann Waters-Bayer's summary of the people aspects of the Congress that more progress over successive Congresses is being made within IRC than in IGC. More of that later

Climate change and rangelands?

The challenges of climate change in the rangelands are significant. However, I thought the issue was somewhat 'underdone' at the Congress. There was some attention given to reducing greenhouse gas emissions from rangeland activities, and in how the capacity for rangelands to sequester carbon can be developed as an ecosystem service that can be rewarded economically.

There was less attention paid to how management systems will need to adapt to change that is happening now, and it would have been good to learn more of 'here and now' experiences in adaptation. For example, we were told that in the northern Chinese and Mongolian grasslands, increasing temperatures and declining rainfall are giving a 'double whammy' in terms of reduced biomass production – and in areas already experiencing management stress. Closer to home, Tony Palmer highlighted that the increased CO₂ level is exacerbating woody weed growth in susceptible systems in Western NSW by giving these species a comparative advantage.

The imperatives in developing countries – can the issues be addressed from within the rangelands?

Given the location of the Congress, and solid representations from Central Asia and Africa, the use and management of rangelands in the so-called developing countries received perhaps more attention than in previous Congresses – and deservedly so.

There were many examples presented of policy failure leading to bio-physical and socio-economic dysfunction. Of interest to outsiders, was the disparity between the official Chinese Government version of very successful management of grasslands and the evidence from scientists and herders that many of the policies being pursued were generating poor and even perverse bio-physical and socio-economic outcomes. The tension in the air in some sessions was high, and could be readily appreciated despite the language barrier. Interestingly, when quizzed privately, the scientists said that they were not prevented from making challenging statements, although they were not popular in official circles.

In respect of policy failure, one delegate recounted a story from an old herder he met who said that ... 'once there were three families in his village, and they could not find the stock for the grass, and now there are 60 families, and the mice have nowhere to hide'.

It is hard to escape the conclusion that too many of the world's rangelands are trying to support too many people. Yet, addressing this fundamental point seems to be something of a taboo subject. Technical and managerial adjustments guided or driven from 'within' the rangeland community can do so much, but ultimately it will be policy decisions made 'outside' the rangelands - at national scale, and perhaps international scale - that will enable fair adjustment to changed circumstances, and feasible alternatives to rangeland livelihoods.

People and policies – is anyone listening?

This leads to a consideration of who 'outside' the rangelands is listening to, and acting upon the advice from

those 'inside' the rangelands. My feeling is that it is not many, and therein lies an important challenge for rangeland folk and future Congresses. Gordon King advised that nearly 80 per cent of delegates were from research or education disciplines. Only 6 per cent identified themselves as administrators.

This needs to change. If the policy makers and funders do not get the messages, the ability of the rangeland profession to have an impact on the policy environment will be limited.

And on the lighter side?

It is always great to catch up with friends from all over the world that one sees every four to five years and also to make new ones. The social functions were very enjoyable, the Mongolian throat-singing was inspirational, and the infamous 'firewater' hazardous!



Photo 1: Mongolian throat singer in full voice at the opening banquet at the Congress

The ARS managed to cause a minor international incident – 3,000 copies of the special China issue of *The Rangeland Journal* were delivered late in boxes to the Conference venue, and were immediately impounded on the bus by the ever-present Police, who assumed that the boxes contained bombs. Fast-talking by Ken Hodgkinson enabled their release and distribution to appreciative delegates. It was good publicity for ARS and the Journal!

The language of 'Chinglish' is fascinating. One favourite encountered on the field tour was a sign that stated 'To prevent your safety, please do not chase the ostriches.' And the birds in questions were emus anyway! There was some righteous wrath from the dinkum aussies present.

Finally, although the beer is tasty and cheap, getting it cold was a challenge. On the Gansu tour, Continuing Committee Chairperson Jim O'Rourke from the USA with the help of yours truly rigged up a great arrangement on our bus that located the bottles of beer in a bag near the air-conditioning outlet. This enabled us to enjoy a moderately cold beer later in the day, with glasses fashioned from empty plastic water bottles.

The value of a joint Congress?

The joint IRC/IGC was planned as a 'one-off' based on circumstances in China. The next IRC will be in Rosario, Argentina in April-May 2011. However, in the Final Business Session of the Congress, both Continuing Committees were empowered to consider another joint Congress in 2015.

For me, arguments in favour are the high degree of overlap in interests between the two organisations, the challenge of getting sufficient international sponsorship for both events, and the pragmatic fact of the increasing cost of international travel.

These points in favour need to be weighed up against the more limited IGC agenda in recent Congresses. If a joint Congress is to be held in 2015, I believe that it will be critical that the 'rangeland identity' of IRC is strongly represented. In particular, the integrated rangeland management issues that IRC has pushed and developed over recent Congresses need to receive full attention. Finally, some debate about these matters in *RMN* over coming issues may help in suggesting a preferred way forward.

Summary Presentations

The main theme of the combined IRC/IGCCongress was "Multifunctional Grasslands and Rangelands in a Changing World". This theme was split into three sub-themes:

1. Grasslands/Rangelands Resources and Ecology;
2. Grasslands/ Rangelands Production Systems; and
3. Grasslands/Rangelands People and Policies.

On the last day of the Congress summary presentations were given for each of these sub-themes by Andrew Ash, Scott Laidlaw and Ann Waters-Bayer respectively. These summaries have been given rave reviews and we are very fortunate to be able to include reports of these summaries in this newsletter. The information was quickly and generously supplied, and is copyrighted by the International Rangeland Congress.

Highlights of Theme A: Grasslands/Rangelands Resources and Ecology

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This congress for the first time brought together the International Rangeland Congress and the International Grassland Congress. Apart from the logistical challenges of a much larger Congress with over 1600 delegates, handled in interesting ways by our Inner Mongolian and Chinese hosts, there was the added aspect of the different philosophies underpinning the two Congresses. Rangeland Congresses have a much stronger social and economic flavour to them compared with Grassland Congresses,

which are more dominated by technologies and innovations in management.

I had the job of summing up Theme A of the Congress, which covered the broad areas of grasslands/rangelands, resources and ecology. Under such a broad Theme there was a diversity of session topics that included; Ecology of Grasslands and Rangelands Resources, Soil Quality and Plant Nutrition, Soil-Plant-Animal Relationships, Sustainability Indicators, Monitoring, Reclamation, Water Resources and Climate Change. In addition to the invited presentations and the spoken contributed papers there were about 900 poster papers in this Theme, which represented a little under half of the posters at the Congress.

Before going into a little more detail about the individual sessions and their highlights, it is worth mentioning the three plenary papers which helped to frame some of the major issues facing the grasslands and rangelands and the livelihoods they support and the ecosystem services they provide.

Alain Peeters, from Belgium, gave an overview of some of the policy challenges facing the environmental management of intensively managed grasslands. He clearly demonstrated that environmental outcomes based on a complex policy environment are difficult to achieve - for example in Europe there is still little evidence of improved biodiversity outcomes despite a major policy shift from production subsidies to environmental incentives. Also new issues, for example biofuels and the trade-offs between clean fuels, food production and environmental outcomes, add to this complex policy environment. He highlighted the challenges for science to have an influential role in such difficult policy environments.

Tom Thurow from the University of Wyoming, gave an overview of the major issues facing rangelands and in a very elegant presentation highlighted how rangelands around the world are well underway to an unprecedented intensification of rangelands. Rangeland resource problems are human problems and if science is to be of benefit it must provide information that is relevant to management and policy.

Carlo Sere, from the International Livestock Research Institute in Addis Ababa, focussed on the challenges facing livestock systems and the people they support in arid and semi-arid grasslands and rangelands in developing countries. Carlos urged a more holistic research paradigm to take advantage of synergies and assess trade-offs between production, environment and social outcomes.

Both Tom and Carlos indicated that better integration was the key to moving forward. I don't believe this message is particularly new to those who have been working in rangelands for many years but from my chatting with people at the Congress it did strike a chord with those working in more discipline-based, intensively managed grasslands.

Ecology of Grasslands and Rangelands Resources

The whole notion of science informing decision-making was highlighted again in the opening invited paper of the Ecology of Grasslands and Rangelands Resources session where Brandon Bestelmeyer noted "Ecology as a science is relevant to rangeland management only as it can be applied to the improvement of decision-making and implementation". This issue of relevance is almost entirely dependent on framing, context and communication. Sadly, this message was not clearly evident in a majority of the 230+ poster papers in this session, many of which had interesting science but too often it appeared to be disconnected from a management context.

A few of the specific papers that were of interest included a group of papers on the issue of species diversity, productivity, soil attributes and resilience in grasslands. We are now getting a better understanding of the diversity-productivity interaction but the challenge remains on how to link this to management.

The effects of grazing, fire and weeds on the productivity and health of grasslands and rangelands still receives much attention. However, identifying the contribution of multiple drivers in complex ecosystems still remains a challenge for grassland/rangeland ecology. Interestingly, there was only one paper in this session on simulation modelling to try to tease out these multiple drivers. I think there is a stronger role for ecological modelling but it appears to be on the decline as a research area in rangeland and grassland ecology, at least in Australia.

Soil Quality and Plant Nutrition and Soil-Plant-Animal Relationships

The next two sessions covered Soil Quality and Plant Nutrition and Soil-Plant-Animal Relationships. There were no big messages to emerge from these sessions but there were a number of interesting papers. Stuart Ledgard from New Zealand working in intensively managed dairy systems put forward a nice example of how multi-criteria analysis has been used in identifying the role of social and economic factors in adoption of nutrient mitigation technologies. Heather Throop from the US painted a fairly alarming picture of how industrial and fossil fuel emissions will greatly increase nitrogen deposition on grasslands and rangelands over the next 40 years. Increased nitrogen from anthropogenic emissions is currently confined to grasslands fairly close to the emission sources and these are quite often improved grasslands that benefit from the additional nitrogen. However, in the coming decades this added nitrogen will begin to affect much larger areas, including low nutrient rangelands where the impacts are likely to be significant in terms of species diversity. Indeed there was a poster paper on how this additional nitrogen might affect Mongolian grasslands.

There was also an interesting group of papers on soil biology and its influence on plant productivity. This is a rich area for further efforts, particularly as issues of soil carbon gain increasing importance. Dean Revell, from Western Australia, showed how you can use an understanding of plant secondary compounds and their

influence on foraging behaviour and diet choices to link with landscape management and health.

Sustainability Indicators and Monitoring

The next two sessions were on the linked topics of Sustainability Indicators and Monitoring. These sessions were dominated by papers from the rangelands community and monitoring has been a recurring theme at all Rangeland Congresses and begs the question, "Are we making progress in achieving monitoring outcomes at both management and policy scales?" Many of the poster papers demonstrated that development of techniques applicable at local scales is alive and well but that still leaves the question, well articulated in a paper by Dave Briske *et al.*, "How do we reconcile our commitment to science-based monitoring with the need for greater stakeholder involvement and increasing integration of local, professional and scientific knowledge."

A number of papers showed that we are beginning to address these challenges as there was a recurring message of the need for a comprehensive monitoring framework that incorporates both biophysical and human dimensions. There is also convergence of thinking on the need for a core set of indicators though challenges remain in developing ones for biodiversity and social indicators, and the need to incorporate multiple scales. Whether it be the US or Australia or Central Asia, getting commitment from policy makers across jurisdictions to a consistent monitoring program is still one of the greatest impediments to monitoring that meets the needs of both management and policy.

There were a number of papers that demonstrated progress on the ground in linking monitoring to management. In an Australian context, Craig James showed how remote sensing and other technologies (e.g. telemetry) are rapidly advancing and Tony Thompson a pastoralist from NSW gave a practical example of integration of technologies to improve pasture and livestock management.

Internationally there are also many advances - for example, in Iran, Bahari *et al.* showed how linking state and transition models, decision support and Bayesian Belief Networks can be used to improve management decisions, while in the Gobi desert (Bolor-Erdene *et al.*) and in East Africa (Demment *et al.*) early warning systems for livestock have been developed linking plant growth models, satellite imagery and communication technologies.

Reclamation

The lead paper by Ed Barrett-Lennard in the session on Reclamation of Grasslands and Rangelands showed that to develop effective restoration options you need to understand the landscape, production, and socio-economic system. The biggest barriers to adoption are not technology limitations but attitude and perceived economic constraints.

A key message running through many of the papers in this session was that the time it takes for systems to fully regain ecosystem function (not just plant biomass) compared with the time it takes to degrade them.

Water Resources in Rangelands and Grasslands

The session on Water Resources in Rangelands and Grasslands highlighted that hydrology has moved on from local scale issues of ground cover and run-off to much larger catchment scale and ecosystem services issues. This was highlighted in the lead paper by Marc Benoit and Karl Wood who showed that ecosystem service provision of water for livestock production, environmental benefits and human consumption is assuming increasing importance, particularly in the context of climate change. The system implications of changed land use on water yields was demonstrated clearly by Mark and Dickinson (NZ) who showed how conversion of grassland to forest can lead to large decreases in water yields in streams.

Climate Change

The last session of this Theme of the conference was on climate change. Three big issues were addressed in this session:

- reducing methane and nitrous oxide emissions
- opportunities for carbon storage in grasslands
- impacts of climate change on agriculture and adaptation options

Methane production from ruminants is a significant issue for grassland systems, particularly in those countries introducing emission trading schemes that is inclusive of agriculture. While some reductions in methane can be achieved through improved feed use efficiency, a major technological breakthrough in rumen modification is needed to significantly reduce methane production.

A number of papers explored the opportunity for grasslands and rangelands to contribute to carbon sequestration through use of deep rooted perennial grasses, better grazing management of rangelands and change fire regimes in savannas. This can have win-win outcomes for both carbon storage and grassland and animal productivity.

There were also a number of nice papers on the impacts of elevated carbon dioxide and/or warming on the productivity and composition of grasslands and rangelands. However, very few papers addressed the issue of adaptation to these climate changes.

Summary

In summary, this Theme highlighted that many rangelands and grasslands are in decline due to a range of pressures. At the same time, however, funding for research and development in grasslands and rangelands ecology is in decline worldwide. This makes it even more important that our rangeland and grassland ecological research is addressing the right problems, in the right context for decision-makers, at the right scale and integrated to achieve true systems outcomes.

Highlights of Theme B: Grasslands/Rangelands Production Systems

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The Theme 'Production Systems' ranged widely from papers on plant gene function to animal production and food quality. While organisationally it was inevitable that the Congress be divided into themes, the overlap between the themes emphasises the continuum in subject matter covered by the Congress.

To give an indication of the scope within the theme the number of poster papers accepted in each session were:

B1 Livestock Production Systems	155
B2 Integration of Crops, Forage and Forest Systems	89
B3 Amenity and Conservation Turf and Turf-grass	25
B4 Developing Improved Plants	99
B5 Domestication of Native Grasslands/Rangelands	89
B6 Seed Science and Technology	84
B7 Forage Quality, Conservation and Utilization	132
B8 Integrated Management of Harmful Organisms of Grasslands/Rangelands	41

As the papers of theatre presentations (invited and offered) and posters are fully reported in the two volumes of the Congress, I'll attempt draw out points made by the presenters which may not be immediately apparent when reading the texts. Main discussion points and a brief summary of the scope of the posters are also included

Livestock Production Systems

In Session B1 the two invited papers provided contrast between temperate grassland and subtropical savannah in Uruguay. Fabio Montossi explained that combining grassland and cropping in a well structured rotation in ley farming was the most sustainable option for farming in Uruguay but due to continuous cropping offering higher short-term profit, grassland had been pushed out to the more marginal areas. He described the technology challenges this poses and demonstrated a technology gap as research stations can produce 1000 kg LWG/ha while the best farmers are producing only about half of that. Peter O'Reagain described his long-term (10 years) stocking rate experiment in a Eucalypt savannah in northern Australia. Under these semi-arid conditions where annual rainfall is highly variable he found that a constant moderate stocking rate over years (despite widely varying scarce annual rainfall) was more profitable, was botanically superior and suffered less soil erosion than that which was at a fixed high stocking rate (set to take advantage of the 'best' years). The most productive treatment produced an average of 21 kg/ha/year! Despite

the differences in conditions, both papers emphasised the economic competitiveness of the most sustainable systems appropriate to the conditions they were describing. However, short term gain often wins over long term stability. In discussion, the issues raised included the limits to applying the northern Australian findings to other semi-arid regions e.g. Africa, the possibly of introducing rest periods (spelling) into the grazing treatments, and concern about the apparent paradox in Uruguay between exporting produce from organic farming or promoting a clean green image and openly embracing the benefits of GMOs and agrochemical usage. Two offered papers presented different aspects of temperate grassland systems. Marta Lourenco presented information from a literature review on the effect of species composition in grazed grassland on polyunsaturated fatty acid (PUFA) content in milk and meat, clovers and biodiverse grassland tending to produce higher PUFA in animal product than perennial ryegrass. Emmer Kennedy described possibilities of extending the grazing season to maximise intake of grazed grass by allowing cows restricted access to grazing when weather is inclement at the extremities of the season.

Posters in this session covered a wide range of topics: from maximising primary production yield and quality, through grazing animal behaviour, comparisons of grazing systems, whole systems, and animal breeds, economic appraisals, animal health to the impact of forage type and animal breed on quality of food. Despite wide diversity many reflected the focus of the two main papers on the importance of sustainability in grass/rangeland livestock production systems whether it be identifying indicators of sustainability on Canadian dairy farms (Belanger *et al.*), advocating the environmental and economic benefits of reintroducing a locally adapted breed of cattle in southern Africa (Bayer *et al.*) or developing a system of winter housing for sheep to reduce pasture degradation and soil erosion in Gansu province in China (Ma *et al.*).

The poster by Allen *et al.* presented evidence in support of grassland experiments running longer than 3-5 years (the usual timeframe imposed by funding bodies). Derner *et al.* concluded that, from a re-analysis of literature comparing continuous and rotational grazing of rangeland, animal or plant production is not overall higher in rotational than continuous grazing systems

Integration of Crops, Forage and Forestry

In Session B2 case studies were reported in both invited papers. Neil MacLeod described a participatory technology development project integration of forage and cropping systems by small holders in Indonesia while Yu-Ying Shen described how alfalfa was integrated into a traditional system of pig-grain farming in the western Loess Plateau in China. In discussion, MacLeod considered that the success of the Indonesian example was mainly due to identification of a genuine need, avoidance of the 'night market' approach (project mentality) and so ensuring meaningful follow-up and continuity to build up confidence, and making available a complete system in which the farmer is helped to make a decision. The Loess Plateau example was considered to have been successful mainly due to the system and its components having been well understood, supportive government strategy and

taking account of operational/sociological factors. 'On-ground teams' were critical to the scale out phase of the Indonesian project and enthusiastic local undergraduates also had a role to play. There was some discussion about the role of stakeholders in successful adoption. It was stressed that, of course, local services needed to be involved so institutional support was essential for continued success.

Some of the 89 posters were concerned with studies quantifying the inter-relationship between forage and crops or trees in integrated systems, including the role of manure or fixed nitrogen from the livestock components on crops, and the use of models to determine optimum combinations of grass and crops. Although not covered in the invited papers, 17 of the posters dealt with varying aspects of the integration of trees or coppice with pasture, the majority relating to Central or South America.

Amenity and Conservation Turf and Turf Grass

Just as for forage grasses, Bob Shearman explained how amenity grasses are continually being improved by breeding and introducing new species to be more stress tolerant, pest resistant, and of higher quality (albeit that the criteria of quality differ for amenity and forage use!). In amenity grasses greenness and resistance to wearing and tearing continue to be improved. The challenges to turf growth and maintenance in modern football stadiums, especially in Northern Europe, due to their structure (excluding light and restricting air movement) and the demands placed on their playing surface were highlighted by Steve Baker. Mathematical models are now used to identify the most vulnerable areas of the turf at different times of the year so that preparations can be made to remedy the environmental constraints. Special rooting media have been developed to increase wear resistance and maximise drainage, and artificial air circulation and winter lighting have been introduced to protect the turf. From a trial conducted to determine the most effective nitrogen fertilisation management to maintain greenness on a lawn, Golinska concluded that the optimum was a moderate total annual rate (160 kg N/ha) applied fortnightly.

Issues raised in discussion included the likelihood of release of genetically modified varieties of amenity grasses and the environmental impact of heavy fertilizer usage on turf grasses. It was considered unlikely that a genetically modified herbicide resistant *Agrostis stolonifera* variety would be released soon due to the danger of gene flow into the natural population. Steps are being taken to use agrochemicals more responsibly on amenity turf, e.g. on golf courses, taking account of the potential impact they can have on surface and underground water quality.

About 40% of the posters were concerned with evaluation of species, varieties or breeders' selections for specific conditions, often related to a particular environmental stress. Molecular techniques featured in a few such as in the use of microsatellite fingerprinting, *Agrobacterium*-mediated transformation and cloning of drought resistance genes.

Developing Improved Plants

The requirement for more appropriate species and improved varieties of currently used species is becoming a priority in areas in which circumstances have changed, e.g. in southern Australia, due to increasing salinity and in Uruguay, where productive forage species are required for marginal land. Serita Bennett explained that rising water tables and increasing salinity in southern Australia are rendering existing forage species (mainly annuals) unsuitable for agriculture. Although perennial legumes, grasses and herbs have been sourced in other Mediterranean-type climatic regions and evaluated for southern Australian conditions, material from more arid regions of the world has been acquired for the driest areas of southern Australia. Development of core collections of germplasm is an important feature in this type of project. Ghamkhar *et al.* described the use of state-of-the-art technology, e.g. DNA markers and ecogeographical data, in the development of collections of bladder and subterranean clovers.

The benefits of interdisciplinary international research programmes in plant improvement were espoused by Monica Rebuffo. She described the interdisciplinary project LOTASSA involving researchers in Europe and South America including molecular biologists, biochemists, microbiologists, plant physiologists, plant breeders and agronomists. The aim is to improve agronomically useful *Lotus* species to cope with drought, salinity and low pH, by exploiting knowledge of the genetics of the model species *Lotus japonicus* in molecular-assisted breeding. It was stressed that in such a programme consideration has also to be given to the most appropriate strain of rhizobium.

Two papers on manipulation of fructan content in perennial ryegrass were presented. The paper by Jensen *et al.* described the characteristics of transgenic perennial ryegrass lines with higher expression of fructan biosynthesis genes than controls. The genetically modified lines maintained higher levels of fructan than controls throughout the growing season and had greater drought tolerance. The paper by Hisano *et al.* described their results on mapping the genes involved in fructan biosynthesis, invoked by conditions during cold acclimation, results of which are likely to lead to cold hardy transgenic perennial ryegrass.

Stimulated by offered papers on genetically modifying grass species to increase their water soluble carbohydrate content, discussion was centred on criticism of European Union opposition to the release of genetically modified organisms. Merit of placing emphasis on *Lotus* spp. was questioned, claiming that members of the genus are not widely used and they usually lack persistence. However, the potential of *Lotus* spp. was defended due to the use of *Lotus corniculatus* in some parts of South America, its promise in the Australian evaluation trials and its tolerance generally to low soil P status.

Posters covered breeding (conventional and transgenics); quantifying genetic diversity; evaluation of species, varieties and breeders' lines (mainly under specific environmental stress); and physiological mechanisms

involved in stress tolerance. The majority of posters were concerned with application of molecular methodology, emphasising the increasing importance of molecular genetics in forage improvement programmes.

Domestication of Native Plants for Regional Use

Collaboration between US rangeland plant collectors in need of more varied germplasm and those from an area with abundance (Mongolia) was described by Doug Johnston. These collections have been lodged where seed is readily available for the development of improved cultivars which will be resistant to grazing pressure on rangelands for wider use. The search for and development of suitable germplasm to restore degraded arid rangelands in Russia and Central Asia was covered by Dzyubenko. Concentrating on halophytes, he considered that there were more than 100 native species suitable for domestication and use in restoration and outlined the process of collecting, maintaining genetic variation, assessing agronomic value and breeding. He described an interesting study in which the original route taken by Vavilov in 1916 was recently retraced. A high proportion of the species collected by Vavilov could not be found suggesting that genetic erosion had been considerable in the intervening 80 years.

Topics of posters included development of native grasses and legumes in US, China and Australia, with over 60% of the posters relating to native species in China. Assessment of genetic variation accounted for more than a third of the posters from China. Collecting and domesticating species from the Middle East and Canary Islands (described earlier) for use in southern Australia was also described. In Discussion concern was expressed about introductions becoming weeds. The danger was widely recognised and it was stressed that its importance should be taken into account in the early stages of evaluation. In conclusion, there is no single solution to sourcing germplasm for pasture or amenity plant improvement as the genetic variation within native populations may not always be sufficiently wide to cope with the degree of change in conditions.

Integrated Management of Harmful Organisms of Grasslands/Rangelands

Invited papers in this session comprised a series of four by range scientists from the US on invasive plants. These papers highlighted the vulnerability of native grasslands to invasion (e.g. Great Basin and Great Plains in the US; Mack), methods to remedy invasion including biological control and targeted grazing management (Wilson) or use of herbicides as catalysts for vegetation change (Sleugh). The potential danger of mutual ingression of species from US and China due to similar habitats and increased traffic between the two countries was highlighted by Brock. Theories on why cheatgrass is so invasive in the US but not in its native range, and optimum quarantine arrangements for introductions were the main topics of discussion.

Posters were more wide ranging than the specialised topics covered by the invited papers. While almost half of the posters were concerned with the ecology or control of weeds invading grassland or rangeland, a further third

were concerned with pest damage and control in grass and rangeland (mainly insects but also including rodents).

Seed Science and Technology

Seed production of native grassland and of bred commercial forages was compared by Phil Rolston. Seed production of native grasses can be difficult as problems have not been selected out in a breeding programme. However there is evidence that native seed crops are improving due to better understanding of their agronomy. Regulations for marketing native seed are not yet developed. A successful village-based project in Thailand was described in which seeds of new grasses and legumes were produced resulting in improved incomes. Christian Huyghe explained, in a thought-provoking paper, the rationale for sexual reproduction in grasses and its implications for sward dynamics and the sward's response to management and renovation. Discussion centred on optimum fertiliser requirements for grass seed crops and suggestions for methods to quantify seed banks.

Posters ranged from factors influencing pollination and seed set to fertilizer management for seed production. The most common category was studies on factors, including stress such as salinity, affecting germination.

Forage Quality, Conservation and Utilization

The importance of conditions in silage, e.g. its content of dissociated acids and its anaerobic conditions, influencing the prevalence of undesirable micro-organisms such as mycobacteria and mycotoxins was covered by Nishino. He developed his paper to consider the probiotic effect of silage. In contrast Nissio, basing his experience of silage-making in the tropics in Brazil, described the relative ineffectiveness of inoculants in the tropics, although acid additives usually have a positive effect on fermentation, at least under experimental conditions. Moisture absorbents also seem to offer some promise as additives. During discussion the benefit in nutritive value terms of using mixtures as opposed to monocultures was discussed. The possible beneficial effects of growing mixtures (or natural vegetation) in which secondary metabolites from some components protect the high N content of other components (e.g. legumes) in the rumen was discussed. The theory that ease of cell damage limits the amount of biohydrogenation of grasses, due to fast rate of passage out of the rumen, resulting in preservation of polyunsaturated fatty acids (PUFA) was tested (Lee *et al.*). Tall fescue cells are more easily damaged than those of timothy and perennial ryegrass, and some of the PUFAs in tall fescue were more protected than in the other 2 species when they were fed to dairy cows.

Almost a quarter of the posters were concerned with management, especially time of harvesting, on herbage or silage quality. The next most common category was effects of inoculants and additives on fermentation and silage quality. The beneficial and adverse effects of secondary metabolites (e.g. condensed tannins and saponins) were also covered in a few posters.

Conclusions

From an IGC perspective, over the past 20 years or so sustainability has increased in prominence in production-

based papers. This has been particularly obvious at this Congress and may have been, at least in part, a consequence of joining with the IRC. An encouraging number of papers reported successful adoption of technology or whole systems, some making a significant contribution to poverty alleviation. There are, nevertheless, technology gaps still to be filled. State-of-the-art technology, e.g. molecular genetics and mathematical modelling, continues to be applied to systems and systems component research. Although only a few papers on the potential importance of the role of forages in the human food chain were presented, their impact signals a research and development area which is likely to become increasingly important. Lastly, a commendable number of posters in Theme B are the fruits of international collaboration; hopefully more co-operative partnerships have been formed as a result of this Congress.

Highlights of Theme C: Grasslands/Rangelands People and Policies

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It is indeed an honour to be invited to bring the highlights of the third major theme of this congress: People and Policies. Listening to the presentation and discussions in this section, I find it exciting that so many natural scientists recognise why people and policy issues are important and are integrating them into their work. Grasslands and especially rangelands are resource-management systems, and – as Thomas Thurow said Tuesday morning – “management is about people” (Thurow 2008¹).

People and Policy in Grassland and Rangeland Congresses

To put the theme of People and Policies in perspective, we first look at how these issues were treated in past International Rangeland and Grassland Congresses (IRC/IGC). Conventional grassland science deals with biophysical constraints to growing enough good-quality grass for animals – constraints related to soil fertility, water supply, plant species etc – and research has focused on how to overcome these constraints using external inputs and technologies. The rangelands are natural pastures in more marginal areas that are too dry, too high or too cold for cultivation. These conditions are not constraints; they are given. One Theme C poster had a quote from a rancher in Colorado: “Basically you have to listen to Mother Nature and take what she has given” (Knapp & Fernandez-Gimenez). Rangeland users try to manage as

¹ From this point onwards, all references in the text without date are to papers prepared for IRC/IGC2008.

well as they can with the available resources, to make optimal use of them, to recognise and use opportunities in an efficient and flexible way.

To address better these distinct issues of rangelands, people working in these areas started holding separate Rangeland Congresses in the 1970s. Initially, the dominant themes were plant-animal interactions, ecology, controlling animal movement and the like. Over time, however, the realisation grew that rangeland use is largely determined by social relations, institutions and policies. At the V Rangeland Congress in 1995 in the USA, Barry Walker (1995) pointed out that – if rangeland science is to influence practice – there needs to be more work on such issues.

That was the first Rangeland Congress I attended, and – as a sociologist – I was pleasantly surprised to see that 30% of invited papers and 12% of the contributed ones had a socio-economic or policy dimension (West 1995). So I kept coming to the IRC. However, with my experience of working in Africa, I was surprised at the IRC focus on American ranchers and Australian graziers. The session on “indigenous peoples” was in an evening, on the margins, so to say.

This changed in 1999 in Australia, where the overall theme of the IRC was “People and Rangelands” (Eldridge & Freudenberger 1999). This meeting was innovative in the way it blended in the sharing of knowledge and culture of the rangelands, including also the paintings and poetry of rangeland users in the lobbies and even in the formal sessions. By the time of the IRC 2003 in South Africa on “Rangelands in the New Millennium” (IRC 2003), already 42% of invited papers and 20% of contributed papers dealt with socio-economic and policy issues.

Meanwhile, back on the grasslands, Ross Humphreys (2005) found that, from 1950 to 2001, about 3–4% of the papers dealt with socio-economic matters and another 2–3% could be classified as having a systems perspective. Our own counting of papers from the XX Grassland Congress in Ireland in 2005 (O’Mara *et al* 2005) indicates that about 7% of all papers dealt with such issues.

Now at this joint congress in China, the organisers made People and Policies one of the three major themes. This means that 1/3 of the invited papers at least nominally deal with this theme. However, only about 10% of contributed papers are in Theme C. This is an even lower level than in the first Rangeland Congress I attended in 1995 – but it does mean a big leap forward for the Grassland Congress!

Highlights of this Congress

And now to Theme C in this Congress. It had eight sessions, covering social, cultural and policy issues, landuse change and tenure, institutional innovations to conserve biodiversity, non-livestock amenities, marketing, innovation systems in practice and education, and the Chinese forum. We won’t go through them now session by session. Instead, we bring highlights, expressed according to key words or phrases and selected according to our own perceptions.

1. *Science and society.* Rangeland science’s response to public demand for more attention to the environment reflects a growing consciousness of links between science and society, a point raised also in Alain Peeters’ plenary presentation. The researchers at this congress are becoming increasingly aware that science will be translated into policy and action only if there is a change in thinking and behaviour not only of landusers but also of policymakers and of scientists themselves, in response to demands from society.
2. *Negotiation of multi-purpose rangeland use.* Several papers presented examples of multi-stakeholder interaction in managing resources to fulfil different functions for the local users and for wider society. A key word that kept coming up was “negotiation” between the stakeholders to reach compromises or sometimes even “win-win” situations, trying to reduce conflict between different objectives primarily related to livelihood and the environment but also to purposes of other users, including the military, with examples of this from Canada (Brant Kirychuk *et al*) and USA (Kreuter & Fox).

The negotiation was often facilitated in the framework of action research to achieve good land management. Different stakeholder groups defined their own values and perspectives related to the resources. Then they tried to understand each other’s perspectives and to reach consensus on goals and indicators of landuse change. This was the start of a process of adaptive co-management. Key is the functioning of the multistakeholder platforms to continue joint assessment, dialogue and re-negotiation as new pressures arise and conditions change (e.g. Dodd *et al*, Dube *et al*, Girard *et al*, Myers *et al*, Sommerhalter, Yan Zhaoli *et al*).

It is obvious, however, that facilitation of such negotiation processes requires skills, time and therefore money that is seldom readily available. What value does and should society give to such facilitation? How are people capacitated to carry out this role on a large scale instead of only in pilot areas? These are questions still to be addressed.

3. *Valuation of rangeland services.* An important basis for such negotiations is laid by efforts to quantify the value of rangeland services. These include also non-tangible benefits such as the aesthetic and cultural value of nature or of life styles. Examples of this were brought from a very broad array of settings ranging from the steppe of Inner Mongolia (Liu Zhongling *et al*) to manicured gardens in rural areas being invaded by the urban middle class in the UK (Phillips).

Maryam Niamir-Fuller stated that standard economic assessments miss out 3/4 of the direct and indirect values of pastoral systems. She found that not enough is documented about these values to provide guidance for policymakers and rangeland users. However, work in this direction is being done: for example, Kirychuk and his colleagues calculated the costs and

benefits of using public land as community pasture on the Canadian prairies. Part of the costs are covered by the livestock owners who graze their animals on the pasture, and part by the public sector for benefits to society, such as soil conservation, carbon sequestration, biodiversity conservation and community development.

A particularly interesting paper in this connection was the one by Jocelyn Davies *et al* from Australia that showed how engagement of Aborigine people in caring for the land led to lower health and social costs for the Australian society as a whole. The value of some benefits of the rangelands in both local and global terms are not well researched; indeed, some benefits, such as what Davies describes, have not yet been recognised in many places.

Valuation of ecosystem services such as biodiversity and carbon sequestration can help calculate what society should pay to landusers for delivering these services. Several papers and posters dealt with incentive payments for managing biodiversity or for habitat recovery (e.g. Kreuter & Fox, Lunt *et al*, Peel & Chaplin). This included market mechanisms to encourage environmentally sustainable resource management, such as the tradable permits for nitrogen discharge around Lake Taupo in New Zealand (Kaine *et al*). There was a tendency in the discussions to favour results-based management, which allowed landusers some discretion in how they achieved the results with the payments made, rather than having to follow prescriptions for managing the land.

It was striking that the discussion around payment for ecosystems services focused on industrialised countries, whereas the valuation of rangeland resources was needed in the South more for defending pastoral systems.

4. *Land rights* was a topic that came up frequently in the discussions, not only in the session on land tenure. Several participants stressed the importance of securing land rights for rangeland users, but pointed out that this does not necessarily mean privatisation of land. Also group or communal rights can be legally secured (e.g. Fernandez-Gimenez & Batjav), or traditional rights to make specific use of resources in a mobile system, such as the rights secured by pastoralists in Spain to use transhumance corridors (Niamir-Fuller) can be obtained.

Esther Mwangi used the metaphor of “wickedness” to explore property rights and governance in Africa’s rangelands, involving multiple actors, multiple definitions of problems, and complex issues of power and equity. She explained that such “wicked problems” can be handled only through interactive and iterative learning.

In this connection, the issue of scale was raised: the need to identify the spatial scale at which different types of rangeland resources are used and communities or societies can govern them

(Sommerhalter). How is it possible to match the scale of ecosystems and the scale of institutions needed to govern them? Who can provide mediation regarding land rights for groupings of stakeholders at different scales? Here, we found no ready answers.

5. *Convergence of knowledge systems*. In Theme C, the value of local knowledge and indigenous institutions was often mentioned (e.g. Genin, Undeland), and there were a few encouraging examples of research that linked local and modern knowledge (e.g. Gebru *et al*, O’Kane *et al*, Reid *et al*) – including cases in which producers play a major role in defining, implementing and even funding the research, such as the whole property comparisons by graziers in Queensland (Hall & Hall). There seemed to be more examples of such partnership in research from Australia and North America, perhaps because there is not such a large social and educational distance between scientists and landusers as there is in the South. However, there was a nice example of participatory development of forage technologies from southern China (Yi Kexian *et al*).

Some papers gave attention also to the dynamics of local knowledge: how landusers – faced with new constraints or opportunities – are developing their own innovations (e.g. Dreyfus *et al*, Huilan Wei *et al*, Kumar *et al*, Waters-Bayer & Yan Zhaoli), including institutional innovations by Inner Mongolian herders who are developing new ways to manage jointly land that has been officially subdivided (Qiao Guanghua *et al*). These innovations provide entry points for scientists and herders to explore the implications of different management options and to derive guiding principles for land management.

6. *Linking to market*. The contributions on markets covered situations ranging from traditionally more subsistence-oriented livestock-keepers trying to link with markets (e.g. Desta *et al*, Kaitho *et al*), to commercial livestock producers in some industrialised countries who had become far removed from consumers (McDermott). Alan McDermott pointed out that affluent and discerning consumers are increasingly demanding quality, traceability and “identity” of food. They want food that meets high environmental standards. Producers are trying to remain in business by linking directly with consumers, e.g. through farmers’ markets, or with processors and retailers.

At least in the industrialised countries and increasingly in developing countries, pressure by high-income consumers will require more producers to take environmental considerations into account, pushing production systems closer to organic ones (Longhi & Pardini).

7. *Complexity and change*. At the Chinese forum yesterday afternoon, Zheng Yisheng focused on complexity. Taking the example of the oversimplified overgrazing hypothesis, he showed clearly how complex the situation really is. He argued that short-

sightedness of herders is only one and probably not the main cause of overgrazing, and focusing on this one aspect could make the situation worse. He spoke of new efforts by Chinese scientists to consider complexity of grasslands. The challenge will be to make this complexity clear to policymakers.

Complexity was also a key word in the presentation by Mark Paine (Paine & Cerf) about educating students in Europe and Australia. Both he and (in the discussion) Monique Salomon from South Africa stressed the need to train students in a systems perspective, to be open to different types of knowledge, to learn how to learn together with others, and thus to prepare students for dealing with complexity and change in rangeland systems.

The complexity of interactions between production practices, value commitments and ecosystem links was illustrated by Bernard Hubert in his presentation on functional integrity of rangeland systems, in which he highlighted the need for scientists and policymakers to appreciate the constant change in interrelationships within these systems.

8. *Policy influence.* In the discussions about policy, we heard that extensive livestock systems characterised by mobility are uniquely adapted to the rangelands (Niamir-Fuller). The viability of pastoralism is often constrained by inappropriate policies that seek to transform it into an intensified sedentary system rather than enhancing mobility. While many “developing” countries are trying to intensify their livestock systems, many industrialised countries are introducing policy instruments to extensify, to promote livestock systems with a high nature value. Jonathan Davies proposed that policy should promote not intensification or extensification but rather optimisation in terms of providing complementary goods and services from the rangelands.

From several countries and continents came examples of how poor policies had led to environmental, economic, social and cultural degradation (e.g. Davies, Han Nianying, Loquang, Niamir-Fuller, Undeland, Wenjun Li *et al* and in the discussions). There seemed to be general agreement with Maryam Niamir-Fuller’s statement that the future of the rangelands will be determined much more by policy than by technology. Therefore, the impact of policy must be well understood (Dube), and the rangeland users themselves need to have the opportunity to give feedback about policy impact (Han Nianying). It was encouraging to see that some Inner Mongolian herders attended the Theme C sessions of this international congress and, during the discussions, could express their concerns about herders’ rights – a topic also raised in one of the papers from the Karamoja pastoralists of Uganda (Loquang).

9. *Integration.* Numerous speakers – also in the plenary (Thurow, Seré *et al*) – stressed the importance of integration: integrating the different disciplines; integrating research, extension and education;

integrating different knowledge systems; integrating production, environment and society. There were a few examples of how research is trying to this, not only through working in transdisciplinary teams but also by engaging in real-life experiments which involved integrated management by landusers (e.g. Davies *et al*, Dodd *et al*, Gebru *et al*, Girard *et al*, Hall & Hall, Kreuter & Fox, Myers *et al*, O’Kane *et al*, Reid *et al*).

In this congress, however, the three themes of Resources and Ecology, Production Systems and People and Policies were segregated. We would have liked to have seen these issues integrated in a more interdisciplinary approach. In a few cases of papers under Themes A and B, this did indeed occur, as we heard from the previous two speakers.

It was striking in Theme C that one of the liveliest discussions took place when a scientist talking about biofuel technology (Moore *et al*) was confronted with questions about social and ethical issues. The congress sessions should bring natural and social scientists together to stimulate such debate.

What struck us most about the participants in the Theme C sessions is that many of them had originally been trained as natural scientists but had, in the course of their work, become more aware of the importance of social sciences. These people now serve as bridge-builders between the natural and social sciences, possibly better than “pure” social scientists could do. Through years of experience, they have internalised the integration of disciplines. It is encouraging that the number of such people – such “integrating scientists” – is growing. They are often women. These women and men have an important role to play as mentors of younger scientists working in the rangelands and grasslands. Many such people were in the Continuing Committees that prepared this joint congress. We thank them for allocating such importance to People and Policies, and hope we can all find ways in future congresses to integrate these issues very deliberately with the other themes.

Finally, we would like to thank the Chinese organisers of this Congress and the many volunteers for making this unique event possible. A great accomplishment!

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INFORMATION WANTED ON FENCES

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For the past decade I have studied rural fences across Australia and internationally. I am seeking biographical information on two people involved in developing fences and gates.

1. Reid lift gates: does anyone have any biographical information on who Reid was, where he lived, worked etc?

2. Robert L. Piesse was a Victorian fencing contractor and expert from the 1950s to the 1980s and who helped develop the fence known variously as "suspension fence" or "Fowlers Gap fence". Does anyone have any biographical information on him?

If you have any biographical or other information on Reid or Piesse, I'd appreciate hearing from you. Please email me at john.pickard@bigpond.com.

BOOK REVIEW

"Carbon sequestration in tropical grassland ecosystems" edited by L. 't Mannetje, M.C. Amézquita, P. Buurman and M.A Ibrahim, 2008. Wageningen Academic Publishers, Wageningen. ISBN 978-90-8686-026-5, 221 pp. Price: €48.

We hear in the press about the modern day devastation of the tropical rainforests of the world for timber, or for conversion to grassland or cropland, and lamentations about the consequent release of carbon into the atmosphere. Quantitative data concerning just how much carbon is released, and just what is the reduction (if any) in the carbon sequestration capacity of the various land use systems following the destruction of the rainforests compared with the original native forests, are few and far between. This book reports the results of a five year, on-farm study of the soil and vegetation carbon stocks of long established pasture, forage bank and silvopastoral systems compared with the adjacent forest and degraded land in tropical America. Estimates were also made of the carbon sequestration rates of the different farming systems in different landscapes using repeated soil and vegetation sampling over a three to four year period.

The four landscapes sampled were in the Andean hillsides of the semi-evergreen forest in Colombia, the Colombian humid Amazonian tropical forests, the sub-humid tropical forests on the Pacific Coast of Costa Rica and the humid tropical forests on the Atlantic Coast of Costa Rica. The overall objective of the project was to identify production systems that increased livestock productivity and farm income as well as sequestering carbon, and contributing to the reduction of CO₂ accumulation in the atmosphere. The project was multi-national including teams of scientists from Universities and Research Institutes in Colombia, Costa Rica and The Netherlands.

The book is comprised of a short Preface, an Executive Summary and a Foreword followed by ten Chapters, each by a different set of authors. Len 't Mannetje made a major contribution to the editing of the book but does not appear in the author list of any of the Chapters, in contrast to his three co-editors. Tragically, Len passed away in February 2008, soon after attending the book launching ceremony in Rome organised by the Food and Agriculture Organisation of the United Nations on the 25th of January.

The Executive Summary is very useful for the time-poor busy reader in that it summarises the whole ten chapters in five pages. The sections on the different chapters are quite variable in length but do give an excellent summary of the major findings. However, for the discerning reader who wants to critically assess the validity of the sometimes surprising findings, a detailed examination of the text of the whole book is both essential and rewarding.

The Foreword by Professor Manuel Rodríguez, an International Consultant on Environmental Policy Issues from Bogotá, Colombia, describes the environmental, social and agricultural context in which the project was undertaken. He emphasises the need for new horizons in

which new socio-environmental policies can be formulated and the short time available for these new directions in the light of extensive land degradation and farmer poverty within the Latin American tropical ecosystems. The findings of this project are somewhat contrary to conventional wisdom and clearly point the direction that these new socio-environmental policies should take. He also emphasises that the results of this project have implications for policy development in other parts of the world and some of them are very relevant for rangeland management in Australia.

Chapter 1 fleshes out the details of the context for the project as indicated in the Foreword and describes in some detail the land use, land use changes and the economic and environmental importance of the pasture and silvopastoral production systems to the region. The specific objectives of the project are listed and were to:

1. "Estimate soil and vegetation C stocks of long-established (10–20 years) pasture and silvopastoral land use systems comparing them with those from adjacent native forest and degraded land.
2. Estimate C sequestration rates of newly-established improved pasture and silvopastoral systems on degraded land, through short-term replicated small plot experiments.
3. Estimate the socio-economic benefits to farmers of establishing improved pasture, agropastoral or silvopastoral land use systems in degraded areas.
4. Identify, within each ecosystem, land use systems that are economically attractive to the farmer, help alleviate poverty and have a high capacity for C storage.
5. Extrapolate project results to similar environments in tropical America.
6. Provide recommendations at local, national and international level, regarding policy decisions to mitigate and adapt to the adverse side effects of climate change, taking into account appropriate land use that provides environmental and socio-economic benefits to farmer populations."

The four ecosystems which were used in these studies are described in some detail, emphasising both their differences and their similarities.

Chapter 2 describes the methodology of the biophysical research and is a critical chapter in the book. The land use systems sampled in each ecosystem are tabulated as are the details of each of the farms used. The classification of the topography into flat or sloping in the Amazonia farms proved to be of importance in terms of the C stocks.

The methodology for forest mensuration has been around for many years and is well accepted and is easily adapted for estimating the C stocks in the above ground parts of forests and woodlands. The estimation of herbage mass in grasslands is likewise well established and again, the conversion to estimates of C stocks is relatively

straightforward. However, the estimation of C stocks in the soil is a new science and the variability both horizontally and vertically presents important sampling problems. The sampling procedures are therefore described in some detail and could well serve as models for future work in other parts of the world. However, there are problems with the descriptions of the methodology used in the laboratory to estimate the C stocks in the soil samples. Only two components of the soil C stocks were measured. These were the oxidisable C using the well established Walkley-Black method. This procedure has been used for many years throughout the world and in Australia; the results are usually referred to as soil organic carbon. The total carbon was then estimated using dry combustion "at 120°C" (p. 42) followed by the estimation of the resultant CO₂ produced. This temperature is clearly wrong because heating the soil to 120°C will not result in combustion of the carbon present. Another description is given on P. 80 where the combustion temperature is given as 900°C. This temperature would result in combustion of much of the soil C but would not include carbon occluded in the silica bodies (phytoliths) from plant leaves, particularly grasses (Parr and Sullivan (2005)). The carbon in these silica bodies is released by heating to 1,300°C and in tropical grasslands growing on acid soils can make a substantial contribution to the estimated C stocks and C sequestration (Parr and Sullivan 2005). Because of the confusion over the combustion temperature, it is not at all clear whether or not the silica body fraction of the soil carbon was included in the total C stock estimates. Parr and Sullivan (2005) found that the silica body carbon is much higher in soils under grassland than under forest. The soils in Tropical America do not accumulate carbonates and so these were not estimated.

Chapter 3 presents the data collected on C stocks in long established, and on C sequestration in newly established land use systems. I found this chapter the most interesting in the book because of my interest in the relationship between land use and soil carbon accumulation or release to the atmosphere. All the C stocks in the following paragraphs are in t/ha/1m-equivalent for soils stocks and t/ha for above ground stocks.

Surprisingly, whether the landscape was flat or mildly sloping produced substantial differences in the C stocks of native forest in Amazonia, Colombia, with a total of 309.5 t/ha on the mildly sloping land and only 182.9 t/ha on the flat topography. Of this total, 41.5% was in the thick roots, and the above ground parts of the forests for both landscapes. These differences were reflected in the results for the long established grasslands where the total C stocks on the flat land were in general lower than those on the mildly sloping land. As expected, by far the majority of the C stocks (between 93.8% and 97.8%) in the grassland communities was below ground. There was little difference between the total C stocks in the regenerating degraded pastures between the two landscapes with 133.2 t/ha on the mildly sloping land and 138.4 t/ha for the flat land. In other words, clearing native forest and grazing the resultant volunteer grassland leads to a substantial loss of C to the atmosphere.

On the other hand, some of the landscapes were managed by sowing high producing grass or grass/legume pastures and the livestock managed in such a way that these pastures were retained for long periods of time. Unfortunately, little information is given of the details of the grazing management. In these cases, the reduction in total C stocks was not nearly so substantial (175.9 t/ha vs 309.5 t/ha for the sloping land and 152.1 t/ha vs 182.9 t/ha for the flat land). In the case of the flat land, the total C in the soil was significantly greater than in the native forest for all except one land use whereas on the sloping land it was significantly lower in all cases.

The position was even more complicated in Costa Rica where the farms sampled were at Espaza on the Pacific coast with a mean annual rainfall of about 2,000 mm and Pocora on the Atlantic coast (m.a.r. 3,500 mm). In this case the total C stocks in the native forest was quite low at Espaza (194.34 t/ha) but was considerable higher at Pocora, with the higher rainfall (315 t/ha). In Pocora, this value was the highest of the land uses sampled, whereas at Espaza, a teak plantation had the same total C stock (315 t/ha) and was the highest of the land uses sampled. On the other hand, the native forest was the fourth highest of the land uses at Espaza but no significance levels are provided.

The carbon sequestration by newly established improved land use systems was studied by establishing replicated small plot experiments on degraded pastures. The initial soil C stocks were estimated in the degraded pastures in each case before the improved land uses were established. These systems comprised different grass monocultures, grass-legume mixtures and forage banks of shrub species regularly cut for animal feed. These experiments were undertaken on the Andean Hillsides in Colombia, in Amazonia, Colombia on flat and sloping land, and in the Aspasrza area on the Pacific Coast in Costa Rica. The carbon sequestration was then estimated by comparing the before and after values of the soil C stocks under the various land use treatments sampled at between three and four years. The degraded pasture plots were also sampled at the end of the experiment to estimate the carbon sequestration under natural regeneration of the degraded pastures.

The amount of C sequestered varied between a significant increase in the soil C stocks of 11.2 t/ha/1m-equivalent/year under a sown grassland at one of the sites in the Andean Hillsides in Colombia to non-significant decreases under several treatments at the other Andean Hillside site. Generally, the soil carbon sequestration was greater on the sloping topography in Amazonia, Colombia than on the flat topography. No information is provided about the grazing management of the sown pastures during the course of these small plot experiments.

The data provided in this chapter clearly show that the clearing of tropical rainforest does not necessarily mean the irreversible release of large amounts of CO₂ into the atmosphere. The C stocks of these forests does vary according to location and landscape features and once cleared, the recovery of the C stocks depends very much on the land use and management. I suspect that regenerative livestock management could result in a

further increase in the rate of C sequestration in these landscapes.

Chapter 4 provides an analysis of the soil variability and data consistency. With such a large project and with many hundreds of analyses performed at different laboratories, data consistency becomes an important issue. In addition, there are issues related to the homogeneity of soils both within and among sampling sites and at different levels of the soil profile. The authors have addressed this problem by various forms of regression analyses of different soil attributes such as total C content and cation exchange capacity. In this way, a lack of soil homogeneity within several sites was identified and the results interpreted accordingly. A lot of data are also provided on the relationship between oxidisable and total soil carbon. A number of data points that are not within the confidence limits of the regression lines were discarded as 'outliers' and I wonder whether they do not result from different forms of carbon such as occluded carbon in silica bodies that may or may not have been included in the total C determination. This chapter is perhaps of more value to someone involved in a similarly large project on soil carbon stocks rather than the casual reader. The next chapter (Chapter 5) investigates the factors affecting soils C stocks using a multivariate analysis approach rather than regressions. As expected, land use most strongly affects soil C stocks and the land use effects are modified by the soil attributes such as clay content, cation exchange capacity of the clay etc.

The next four chapters of the book deal with socio-economic research aimed at identifying livestock production systems that are able to capture atmospheric carbon and could be financially attractive to farmers. The objectives of this research are set out in Chapter 6 and were to:

1. "characterise the socio-economic conditions of farms participating in the project;
2. describe land use on farms included in the project;
3. define establishment costs and operating expenditures of different C sequestering livestock systems, as well as their production and revenue levels;
4. explore the financial feasibility of investing in different C sequestering livestock systems;
5. develop models on the financial effects that a potential payment for C storage may have as an incentive to incorporate C sequestering livestock systems on farms;
6. provide policy guidelines to promote implementation of C sequestering livestock systems by farms in Tropical America."

Data needed for the socio-economic analysis were gathered from 48 farms, 19 in the Andean Hillsides of Colombia, 20 in the Colombian Amazon region and 9 in the semi-humid tropical forests of Costa Rica. The next step was the distribution of a set of registers to a sub-set of the original farmers who were willing to provide further

information. These registers recorded production levels, operating costs and farm activities. This information, together with information from secondary sources, was used to develop financial models within the different landscapes of different sorts of investments in pasture and livestock management systems.

The results of the surveys, data collection and modelling and the implications for policy are described in Chapter 7. In general, the extra costs involved in establishing high producing land use systems resulted in increased financial returns in most situations. In some situations, depending on farm size and the landscapes involved, the effect of payment for C sequestration could be an incentive to induce farmers to invest in such improvements, whereas in other situations, this payment would be relatively marginal in terms of making the investments financially profitable. Policy interventions in terms of the provision of loans (green credits) to finance land improvement, technical assistance for managing the improved land management systems and the provision of inputs such as tree seedlings would be essential for the widespread implementation of the changed management envisaged.

Chapter 8 includes some reflections on various modelling systems and their applicability to the subject of this book. At first I thought this material was somewhat out of place but on reflection realised that it is indeed very pertinent. One of the problems with models is that there is a tendency by people who are not familiar with the pitfalls of modelling to accept the results of a model as being indicative of what will certainly happen in the future. This has been the case in the popular press with respect to models of climate change. Therefore, this chapter is very pertinent and I would certainly urge those among our readers who are not familiar with models to read it carefully and apply the information in it to a wider context of their experience.

How far can the results of this five-year project be extrapolated? The extent of the similar environments in Tropical America are described in Chapter 9 and how reliably the results from this study can be applied to other areas. The conclusion is that better spatial data concerning the region are really required to have confidence in many of the extrapolations within the region.

I think the major message in this book for Australians is that there is no substitute for measuring soil C stocks in a wide range of rangeland and grassland communities under a range of management regimes. It is critical to better understand the sampling problems involved in estimating soil C stocks so that we can get a better handle on the effects of land management on soil carbon loss and sequestration. The only way to gain this understanding, is for more people to start collecting data so that the best ways of doing it will emerge. Sequential data collection is essential and the project described in this book provides an excellent model.

The conclusions from this excellent project are described in the final Chapter together with some policy recommendations for the region. Well managed pasture or silvopastoral systems can sequester significant amounts of

carbon, by far the majority of which is in the soil, as well as allowing deforested and degraded landscapes to recuperate. There is a need for countries in the region to review policies that see reforestation as the only option for degraded pastures that were once natural forest. Land management systems that increase the agricultural production from these pastures as well as sequestering substantial quantities of carbon in the soil are seen as a more viable option than reforestation. However, the effects of different land management are site specific and so the identification of the potential of different parts of the landscape for determining future land use is essential.

It seems to be widely accepted among the community that the only way to effectively sequester carbon from the atmosphere is to plant trees. Changing land use to sequester carbon into the soil is an emerging and attractive alternative (Lal 2007) and this book provides further evidence that this can be done effectively in tropical ecosystems. I would certainly recommend it as required reading for anyone seriously interested in land management and carbon sequestration.

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The Australian Rangeland Society

DIRECTORS' REPORT FOR 2007

[Ed - This is an edited version of the Directors Report presented at the Annual General Meeting of the Society held in May 2008]

The Society publishes and circulates three newsletters and two journals to the members annually, runs a biennial conference, provides grants to assist members with travel and research and promotes the advancement of the science and art of using Australia's rangeland resources for all purposes commensurate with their continued sustainability and productivity. There were no significant changes in the nature of these activities in the 2007 Year.

Review of operations

2007 was a year of ongoing consolidation and review for the Society. The new Council were finding their feet and coming to grips with their new roles. The main activities for the financial year were:

- Confirmation from ASIC in November 2007 of change in Directors (appointed PW Johnston, VE Bailey and P Marin, ceased DG Wilcox, AME Van Vreeswyk and TJ Ferraro) and change in the registered office of the Society (from 2 Dulhunty Avenue, Dubbo, 2830, NSW to 5/6 Myra St., Parkside, 5063 South Australia);
- Graeme Tupper taking on the role of Subscription Manager in November 2007 following the meritorious work of Ian Watson;
- Initiated planning in June 2007, for the 15th Biennial Conference of the Society to be held in Charters Towers, Queensland from 28 September to 2 October 2008;
- Awarding three travel grants to the total value of \$8,189 in December 2007;
- Initiated in September 2007 the re-design of the Society's website;
- The appointment of two new international Associate Editors for the Journal in November 2007;
- Renewal of the contract with CSIRO publishing for publication of the Society's journal for the three years 2008, 2009 and 2010 (Volumes 30, 31 and 32); and,
- Publication and distribution of three issues of the *Range Management Newsletter* (March, July and November 2007) and two issues of *The Rangeland Journal*.

Council met four times during 2007 year and also held an Annual General Meeting. Each meeting was via teleconference. The following people were members of the ARS Council during 2007:

P Johnston	President
V Bailey	Secretary
P Marin	Finance and Audit Officer/Company Secretary
G Tupper	Subscription Manager / General Member
T Ferraro	Immediate Past Finance and Audit Officer / General Member
S van Vreeswyk	Immediate Past Secretary / General Member
J Taylor	General Member
A Walsh	General Member

In addition to Council, the Society continues to rely heavily on a number of volunteers who fulfil vital roles. These are:

Dr K Hodgkinson	Chair, Publications Committee
Dr R D B Whalley	Journal Editor and Publications Committee
Dr N Duckett	Newsletter Editor and Publications Committee
Dr I Watson	Immediate Past Subscriptions Manager
K M W Howes	Production Manager
Mr B Shepherd	Chair, Conference Organising Committee
Ms B Nelson	Secretary, Conference Organising Committee

Mr M Sullivan
 J Batory
 Dr A J Ash
 Dr R Long
 Dr B Cooke
 Professor L 't Mannetje
 Mr N D Macleod
 Dr B E Norton
 Dr M Stafford-Smith
 Prof M Fernández-Giménez
 Dr B Bestelmeyer
 Dr D G Burnside
 K Andrews
 I Oliver
 Dr D J Eldridge
 Dr P W Johnston

Treasurer, Conference Organising Committee
 Website Manager
 Associate Editor
 Associate Editor
 Associate Editor
 Associate Editor
 Associate Editor
 Associate Editor
 Associate Editor
 Associate Editor
 Publications Committee
 Publications Committee
 Publications Committee
 Publications Committee
 Publications Committee

Publications

The publishing and circulation of professional and highly regarded publications in the form of three newsletters and two journals per year to members continued under the guidance of the Publications Committee and their respective Editors and Associate Editors.

In 2007, Council renewed its three year agreement with CSIRO Publishing to have *The Rangeland Journal* published both electronically and in hard-copy for the years 2008, 2009 and 2010 (Volumes 30, 31 and 32). The Journal continued to be made available in hard copy and electronic form to members in categories other than Libraries and kindred institutions. The latter two may receive the Journal in electronic form only, or, at a higher subscription, electronic form plus print. The *Range Management Newsletter* continues to be published in hard copy form only.

Although the cost of electronic publication is greater than that by conventional means, Council is still of the opinion that this change was necessary if the Society is to persist as a vital body capable of providing impartial advice and opinion for policy makers and the community generally on rangelands and their use. It is pleasing to note the number of papers submitted to the journal continues to increase following the publication of the first Issue by CSIRO Publications in 2005. Sixty-nine papers were received in 2007 (56% from Australia). This is the largest number of papers that has ever been received in one year indicating increased confidence in the journal particularly from Asia and the Americas.

The international presence of the Journal was enhanced with the appointment of two new international Associate Editors for the Journal, Professor Maria Fernández-Giménez from Colorado State University and Dr Brandon Bestelmeyer from New-Mexico State University.

Other highlights for the Journal include negotiating two special issues of the Journal for publication in 2008. The first, Desert Knowledge, was sponsored by the Desert Knowledge Cooperative Research Centre and the second on China's rangelands will be distributed to all delegates at the XXI International Grassland Congress and VIII International Rangeland Congress to be held in Hohhot, China in June-July 2008). The Desert Knowledge issue is the largest single issue ever produced by *The Rangeland Journal* comprising 17 papers and a Guest Editorial and running to 195 A4 pages.

The recommendation from the Publications Review Committee in December 2005 that the Journal become more international is being achieved, and we hope that the distribution of the Special Issue at the combined Congress will aid in this process.

Biennial Conference

Planning for the 15th Biennial Conference of the Society commenced with a meeting in Emerald on 26 June 2007. The 15th Conference of the Australian Rangeland Society will be held at The World Theatre in Charters Towers, Queensland, Australia, from 28 September – 2 October, 2008. The conference theme "A Climate of Change in the Rangelands" will be focussing on the changing environmental, social, cultural and economics facing Australia's rangelands in the future and linking this dynamic to the broader community's real values concerning the rangelands. JK Connections have been appointed as the professional conference organisers.

Membership

Membership of the Society has been declining since a peak of 638 in 1989 have remained more or less stable from 2002. Changes associated with "Library" subscribers were made as part of the move to electronic publishing. This resulted in about

60 "Library/Institutional" subscribers being removed as members. However, the number of individual and family members remains around the same.

A fourth year of similar individual membership numbers would appear to indicate that the current number of members is sufficient to maintain the viability of the Society for the time being, but not high enough to allow any major new initiatives. It is hoped that electronic publishing will, in time, provide an increase in membership and financial viability of the Society.

While there were a number of resignations in 2007, the number of new members was similar.

Just on three-quarters of the membership receive both *The Rangeland Journal* and the *Range Management Newsletter*.

The clear signals from the trends with membership numbers and categories are:

- The need to determine how to keep members engaged once they have joined;
- To review focus areas within the Society and expand the topics it considers to encompass broader influences on Rangelands (e.g. indigenous knowledge, social sciences); and
- Particularly to establish the Society as having a world view of rangelands and not one limited to Australia.

The Council continues to work on responses to the above issues.

Financial

The financial affairs of the Society remain on a strong footing with a loss from ordinary activities of \$1,550 (2006: profit of \$55,209) and total equity/retained profits of \$216,887 (2006: \$218,437).

While individual membership numbers remained similar, differing collection times for membership fees and the changes associated with electronic publishing detailed above mean that membership fees for the financial year decreased to \$20,412 (2006: \$23,782). Professionally run biennial conferences continue to have a positive impact on the Society's financial position and Council looks forward to the 2008 conference delivering a healthy surplus for the Society.

The Society's total equity is \$216,887 which is more than adequate to cover any liabilities.

The Society continued to work on improvements to programs and protocols to allow it to complete its commitments to standard reporting of its financial position as required under law.

Other matters

Three travel grants to the total value of \$8,189 were awarded to members of the Society in December 2007. These were to Paul Erkelenz (\$2,000) and Merri Tohill (\$2,000) to participate in the XXI International Grassland Congress and VIII International Rangeland Congress to be held in Hohhot, China in June-July 2008, and to Nigel Tomkins (\$4,189) to attend the joint annual meeting of The American Forage and Grassland Council and The Society for Range Management in Louisville, Kentucky, followed by visits to leading rangeland scientists at New Mexico State University.

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 Acting Secretary, Sandra Van Vreeswyk, before **30 November**. An application form can be downloaded from the ARS website at www.austrangesoc.com.au. For further information contact Sandra by phone on 08 9191 0333 or email at svanvreeswyk@agric.wa.gov.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]

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/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
Part (Newsletter only)/Student

\$85.00/\$65.00
\$50.00/\$35.00

\$105.00/\$85.00
\$60.00/\$40.00

Company -

Full (Journal + Newsletter)
Part (Newsletter only)

\$115.00
\$65.00

\$140.00
\$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.