

*Celebrating diversity:
people, place and purpose.*



Australian Rangeland Society **17th Biennial Conference**

Kununurra, Western Australia
23 - 27 September 2012

Principal Partner

RioTinto

Major Partners





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PREFACE

On behalf of the Organizing Committee, I welcome you all to the 17th Biennial Conference of the Australian Rangeland Society. We are delighted that you have travelled to Kununurra in Western Australia's Kimberley region for what we hope, and believe, will be an excellent conference.

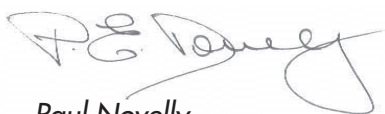
Rangelands, with their unique values and management issues, are framed by the people who live and work in them, and the aim of this conference is to acknowledge and appreciate the diversity of people, cultures and uses that make the Australian rangelands what they are. The theme for the conference is 'Celebrating diversity – people, place and purpose', and it provides a great opportunity to showcase the character as well as the variety of rangeland activities in the East Kimberley. This theme also recognises the huge variety of landscapes and habitats throughout the 80% of the Australian continent that can be classified as rangelands. In particular, the conference is highlighting the regional opportunities for pastoral, agricultural, tourism, conservation and mineral development existing throughout the rangelands, with Kununurra and the East Kimberley an excellent venue for considering the prospects.

The program reflects the range of rangeland interests and activities, and sessions cover a wide range of topics. As well as the presented papers, the posters and the discussion sessions, the field trips to view developments associated with Ord Stage 2, discuss pastoral management in the Kimberley, learn about incorporation of Indigenous fire management practices in managing the region's renowned biodiversity, and finally, to visit tourist attractions in the Ord River Valley and Lake Argyle provide a practical demonstration of the options and possibilities, the challenges and the potential conflicts that epitomize the Australian rangelands in the 21st century.

We also appreciate that while many of the drivers for change in the rangelands relate to the domestic economic and regulatory environment, global trends and forces play an increasing role. We are therefore pleased that the Conference keynote speaker is Prof Jerry Holechek from the USA. Jerry will outline how global trends in population, energy use, water use and climate impact on rangeland and rangeland users, and the implications for policy development, use and management, conservation and production. We hope the program will provide a venue for serious discussion and debate about rangeland diversity and multiple use by complementary interests and cultures.

Like all ARS conferences, we are greatly indebted to and acknowledge the support of the range of sponsors that have assisted us in putting this conference together. Additionally, we are grateful to the various individuals, groups and businesses that have assisted us in so many ways in making this conference what we hope it to be.

We encourage you to contribute your views during the conference's four days, to enjoy the social and networking side of ARS conferences, and we hope that you find the conference rewarding, informative and above all a lot of fun.



Paul Novelly

Chair

ARS 17th Biennial Conference Organizing Committee

COMMITTEE MEMBERS

Australian Rangeland Society
17th Biennial Conference
Organising Committee Members

<i>Dr. Paul Novelly</i> (Chairperson)	Department of Agriculture and Food, Western Australia - Perth
<i>Dr. Tony Brandis</i>	Environmental Consultancy
<i>Dr. Don Burnside</i>	URS Australia Pty Ltd, Perth
<i>Mr. Nathan Connor</i>	Department of Environment and Conservation - Kununurra
<i>Mr. Rob Cossart</i>	Department of Water - Kununurra
<i>Ms Jennifer Duffecy</i>	Anglicare WA
<i>Mr. Ben Forsyth</i>	Beefwood Pastoral Company, Meekatharra
<i>Dr. Pauline Grierson</i>	University of Western Australia
<i>Dr. Alec Holm</i>	Alexander Holm and Associates
<i>Mr. Trevor Howard</i>	Department of Environment and Conservation - Bunbury
<i>Ms Kath Ryan</i>	Department of Agriculture and Food, Western Australia - Kununurra
<i>Mr. Troy Sinclair</i>	Department of Environment and Conservation - Kununurra
<i>Ms Sandra Van Vreeswyk</i>	Department of Agriculture and Food, Western Australia - Broome
<i>Mr. Ray Bird</i> (Co-ordinator)	Meeting Masters

ACKNOWLEDGEMENT

The Council of the Australian Rangeland Society and the Organising Committee for the 17th Biennial Conference acknowledge with gratitude the assistance and support provided by the following organisations and people:

- ~ All the sponsors of the Conference for their contributions.
- ~ The employers and affiliations of members of the Organising Committee for supporting their time in planning the Conference.
- ~ The Shire of Wyndham-East Kimberley and the Miriuwung Gajerrong People for their generous welcome to the Shire and to Country.
- ~ The Western Australian Departments of Agriculture and Food, Environment and Conservation, and Water for supporting the Field Tours.
- ~ JJJ and 2K Tours for their assistance in providing transport.
- ~ The proprietors and managers of Consolidated Pastoral Company for hosting the 'Kings in Grass Castles' tour.
- ~ The Kununurra Visitors Centre for organising accommodation.

PROGRAM

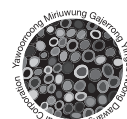
Sunday 23 September

3.00 pm Registration desk open. Kununurra Leisure Centre

6.30 - 8.30 **Civic Reception** Pinctada Kimberley Grande
Drinks and hors d'oeuvres.



Shire of Wyndham
East Kimberley



7.00 Official Welcome:
John Moulden President, Shire of Wyndham - East Kimberley
Welcome to Country: *Ted Carlton, Miriwung Gajerrong People*

PROGRAM

Monday 24 September

7.00 am Registration desk open. Kununurra Leisure Centre

Pre-Conference Field Tours.

7.30 Field Tours 1 - 3 depart.

11.00 Field Tour 4 departs.

2.30 pm Field Tours 1 - 3 return.

5.30 Field Tour 4 returns.

6.00 - **Kimberley Barbecue.** Kununurra Country Club
9.00 Social Event: BBQ and drinks.



PROGRAM

Tuesday 25 September

7.30 am Registration desk open. Kununurra Leisure Centre

Conference opening

8.30 Welcome to conference: *Paul Novelly*

8.35 Official opening: *Hon. Wendy Duncan MLC*

8.50 Conference camp boss: *Troy Sinclair*



Session 1 Global trends and impacts on rangeland and users.

8.55 Chair: *Margaret Friedel*

9.00 Keynote Address:

How global trends in population, energy use, water use and climate impact on rangeland and rangeland users. Implications for policy development, land use and management, conservation and production. *Prof. Jerry Holechek*

10.00 Morning Tea

Session 2 Global trends and impacts on rangeland and users.

- 10.40 Chair: *Margaret Friedel*
Presented Papers:
- 10.45 1) What will climate change really mean to graziers in the Western Catchment of NSW.
Katrina Gepp
- 11.03 2) Producing climate clever beef in Northern Australia. *Steven Bray*
- 11.21 3) Soil carbon and landscape function: grazing friend or foe? *Helen King*
- 11.39 4) Dust Storms - what do they really cost?. *John Leys*
- 11.57 Plenary discussion.

12.15 pm Lunch

Session 3 Land use planning for multiple users and uses.

- 1.10 Chair: *Robert Cossart*
Presented Papers:
- 1.15 1) Kimberley Regional Planning and Infrastructure Framework - accommodating aspirations of different land users and resolving conflicting demands for land.
Cate Gustavsson
- 1.38 2) WA Science and Conservation Strategy for Kimberley. *Daryl Moncrieff*
- 2.01 3) Balancing tradeoffs between biodiversity and production in the re-design of rangeland landscapes. *Cathy Waters*
- 2.19 4) A conservation planning framework for South Australia's arid lands. *Allen McIlwee*
- 2.37 5) The Rangelands Reform Program: Implementing a plan for economic diversity in the Western Australian rangelands. *Hon. Wendy Duncan MLC*
- 2.55 6) Cattle, carbon, critters and culture - building a new rangelands. *Tim Wiley*
- 3.13 Plenary discussion.

3.30 Afternoon tea.

4.00 - 5.00 Poster Viewing.

Global trends, land use Planning. Policy, functioning of ecosystem 1.

Evening Evening Free: Kununurra venues.

8.00 am Registration desk open. Kununurra Leisure Centre

Session 4a Livestock production in the Australian rangeland.

8.30 Chair: *Ralph Shannon*

8.35 Daily muster from sessions 1 - 3.

Presented Papers:

8.40 1) The livestock industry and its future in the Australian rangeland. *Mick Quirk*

9.10 2) Providing a diversity of management to achieve a greater plant diversity. *Angus Whyte*

9.50 3) Seeking sustainable productivity improvements in the northern beef industry.
Leigh Hunt

10.10 4) Scaling grazing trial results upwards to a whole property level - a case study using
Wambiana grazing trial. *Joe Scanlon*



Department of
Agriculture and Food



10.30 Morning tea.

Session 4b Impacts of climate & grazing pressure on livestock production systems.

11.00 Chair: *Ralph Shannon*

Presented Papers:

11.05 5) Sustainable development of VRD grazing land.
Steve Petty

11.25 6) Case study: Nutritional wisdom at work in a grazing enterprise. *Nan Bray*

11.45 7) Long term effects of different grazing strategies on productivity, profitability and land
condition in a variable climate. *Peter O'Reagain*

12.05 pm 8) Optimising capital investment and operations for the livestock industry in Northern
Australia. *Ian Watson*



Department of
Agriculture and Food



12.30 Lunch.

Session 5 Landusers Q & A forum.

1.25 Facilitator: *Ben Forsyth*

1.30 *Mark Irwin*

Lawford Benning

Chris Henggeler



S. Kidman & Co Ltd

3.15 Daily muster from sessions 4a and 4b.

3.30 Afternoon tea.

4.00 - 5.00 Poster Viewing.

Livestock production, fire and functioning of ecosystems 2.

6.30 Gala Conference Dinner.

Master of Ceremonies: *Ralph Shannon*

ARS presentations.

RioTinto

8.00 am Registration desk open. **Kununurra Leisure Centre**

8.00 Australian Rangeland Society General Meeting.
Chair: **John Taylor** President, Australian Rangeland Society

Theme: Understanding rangeland ecosystems and assessing impacts.

Session 6a Functioning of rangeland ecosystems from site to landscape.

9.40 Chair: **Ian Watson**

Presented Papers:

9.45 1) Strengthening scientific research and management across northern Australia through Indigenous rangers and community collaboration. **Rebecca Dobbs**



Catchment Management
Authority
Western

10.03 2) Revegetation with Australian native grasses - a reassessment of the importance of using local provenances. **Wal Whalley**

10.21 3) Ecosystem Management Understanding (EMU)™: Building landscape literacy to rehydrate the rangelands of South Australia. **Janet Walton**

10.40 Morning tea

Session 6b Assessment and monitoring of impacts on rangeland ecosystems.

Presented Papers:

11.15 4) Designing new monitoring programs for Mulga woodlands - lessons learned from the Pilbara.
Gerald Page



Catchment Management
Authority
Western

11.33 5) The impacts of grazing land management on the wind erodibility of the Mulga Lands of western Queensland, Australia. **Helene Aubault**

11.51 6) Microclimate and soil properties of older bilby diggings at Lorna Glen rangelands restoration project. **Tamra Chapman**

12.09 pm Plenary discussion.

12.30 Lunch

All Season Hotel**Session 7****Fire management in a carbon economy.**

9.40 am

Chair: *Dionne Walsh*Department of
Environment and Conservation

Presented Papers:

9.45

1) Fire management in a new rangelands economy: Making sense of research, policy and on ground implementation. *Jeremy Russell-Smith*

10.05

2) Optimising fire management in grazed tropical savannas. *Robyn Cowley*

10.25

Morning tea

10.55

3) The effect of fire frequency and patch dynamics on soil carbon fluxes in tropical rangelands. *Diane Allen*

11.15

4) Above and below ground carbon dynamics of different fire regimes in extensive grazing systems in northern Australia. *Leigh Hunt*

11.35

5) Carbon opportunities to benefit the rangelands economy - a landholder perspective.

11.55

Plenary discussion with session participants - what research and policy requirements are needed now? Facilitator: *Dionne Walsh*

12.30 pm

Lunch

Kununurra Leisure Centre**Session 8****Policy development and implementation in rangeland.**

1.15

Chair: *John Taylor* President, Australian Rangeland Society

Presented Papers:

1.20

1) Re-imagining Western Australia's degraded southern rangelands through knowledge based redevelopment planning. *Rod Safstrom*Regional
Development
Australia
KIMBERLEY

1.40

2) Mesquite management in the NSW rangelands; A history of policy, management and landholder's perceptions. *Matt Goulton*

2.00

3) Implications of alternative feral goat management strategies for natural resource management policies in NSW rangelands. *Salahadin Khairo*

2.20

4) A national approach to building resilient rangelands. *Kate Forrest***Session 9****Conference Summation and Close.**

2.40

Presentations and awards.

2.50

Summation - conference main themes, outcomes and recommendations. *Ron Hacker*

3.10 - 3.30

Afternoon tea and departure

Session 1

Keynote Address:

How global trends in population, energy use, water use and climate impact on rangeland and rangeland users. Implications for policy development, land use and management, conservation and production. *Prof. Jerry Holechek*

Global trends and impacts on rangeland and users.

Session 2

Presented Papers:

- 1) What will climate change really mean to graziers in the Western Catchment of NSW. *Katrina Gepp*
- 2) Producing climate clever beef in Northern Australia. *Steven Bray*
- 3) Soil carbon and landscape function: grazing friend or foe? *Helen King*
- 4) Dust storms - what do they really cost? *John Leys*

Keynote Address:

How global trends in population, energy use, water use, and climate impact on rangeland and rangeland users. Implications for policy development, land use and management, conservation and production.

*Jerry L. Holechek*¹

¹ Department of Animal and Range Sciences
New Mexico State University
Las Cruces, New Mexico 88003, USA
Email: holechek@nmsu.edu

Abstract:

Increasing world human population, declining reserves of cheaply extracted fossil fuels, fresh water scarcity, and climatic instability will put tremendous pressure on world rangelands as the 21st century progresses. It is expected the world human population will increase by 40 percent by 2050 but fossil fuel and fresh water reserves will be drastically reduced. Avoiding food shortages and famine could be a major world challenge within the next 10 years. Under these conditions, major changes in basic world policies relating to economic growth and natural resource use seem essential. Human population stabilization; clean, renewable energy development; enhanced water yields and quality; increased livestock production; and changed land use policies that minimize agricultural land losses to development and fragmentation will all be needed to avoid declining living conditions at the global level. The health and productivity of rangelands will need to receive much more emphasis as they are the primary sources of vital ecosystem services and products essential to human life. Changes in tax policies by developed, affluent countries, such as the United States, Australia, and Canada, are needed that emphasize saving and conservation as opposed to excessive material consumption and land development. Extreme debt levels and chronic trade deficits by the United States and European Union countries must be moderated to avoid a devastating collision of debt, natural resource depletion, and environmental degradation. Over the next 10 years, range livestock producers will benefit from a major increase in demand and prices for meat. Rapidly increasing demand for meat in China is driving this trend. However, ranchers are also likely to encounter greater climatic, financial, biological, and political risks. Higher interest rates, higher production costs, and higher annual variability in forage resources are major challenges that will confront ranchers in the years ahead. Under these conditions, a low risk approach to range livestock production is recommended that involves conservative stocking, use of highly adapted livestock, and application of range livestock behavioral knowledge to efficiently use forage resources.

Presented Paper:

What will climate change REALLY mean to graziers in the Western Catchment of NSW.

Katrina Gepp

Western Catchment Management Authority
PO Box 692, Broken Hill, NSW 2880, Australia.
Email: katrina.gepp@cma.nsw.gov.au

Key words: climate change, graziers, western catchment in NSW.

Abstract:

Graziers in the Western Catchment of New South Wales (NSW) experience a climate that varies both seasonally and across the region with several implications for how land, water, pasture and animal production are managed. The Western Catchment Management Authority (WCMA) is a statutory authority managing the natural resources of the Western Catchment, an area of 230,000 square kilometres (29% of NSW) and encompasses multiple land uses including extensive grazing, dryland cropping, irrigated agriculture, mining, tourism and nature conservation. The implications of predicted climate change for graziers are blurred by an overload of information - often clouding the issue of 'does climate change exist and are any changes necessary'. This leads to uncertainty that then impacts on short and long term management decisions. Current literature demonstrates that there is evidence of upward trends to temperature, rainfall and carbon dioxide (CO₂) levels at a global, national and regional level. Regardless of how these changes are named, the evidence illustrates that they are real trends. Graziers can expect changes in plant and animal migrations, erosion, algae blooms, heat stress-related animal production issues and grasses being out-competed by thickening woody cover. To manage uncertain changes, graziers must have the capacity to evaluate, implement and monitor strategic management options – ensuring their ability to adapt and be resilient. This paper identifies predicted needs for change that are within the means and abilities of landholders as well as supporting agencies.

Presented Paper:

Producing Climate Clever Beef in northern Australia.

S.G. Bray^{AC}, *D. Walsh*^B, *R. Gowen*^A, *K. Broad*^A, *B. Daniels*^A

^A Department of Agriculture, Fisheries and Forestry, Queensland.

^B Department of Resources, Northern Territory.

^C Corresponding author. Email: steven.bray@daff.qld.gov.au

Key words: profitability, greenhouse gas emissions, carbon sequestration.

Abstract:

Northern Australian beef businesses are currently facing a challenging time with significant pressure on profitability across all regions. Simultaneously, the community and Government are concerned about the environmental impact of the beef industry (e.g. greenhouse gas emissions).

The Climate Clever Beef initiative aims to increase the adoption of practices that optimise productivity, profitability, resource condition and greenhouse gas emissions outcomes. A framework was developed which was a powerful tool to identify and analyse management options for individual beef businesses.

The process enabled the identification of “win-win” management options where both profitability and greenhouse gas emissions were improved and highlighted the magnitude of any trade-offs for other management options.

This paper presents a summary of three case studies from three diverse regions in northern Australia, including two examples on the impact of management options on livestock greenhouse gas emissions and one example of carbon sequestration through regrowth management. Key findings include:

- ~ Total emissions are likely to increase with property development and herd build-up.
- ~ Carbon sequestration with regrowth retention may provide opportunities.
- ~ Some management options can improve both herd efficiency and greenhouse gas emissions intensity.

Presented Paper:

Soil carbon and landscape function: grazing friend or foe?

Helen P King^A

^A Fenner School of Environment and Society,
Australian National University, ACT 0200,
Email: helen.king@anu.edu.au

Abstract:

The majority of Australian grazing lands have been degraded since European settlement, resulting in loss of soil carbon and reduced capacity to provide ecosystem services, from primary productivity and climate moderation to social and aesthetic values. Land degradation has also reduced resilience, making grazing land more vulnerable and less able to adapt to the impacts of climate change. With an already variable climate, much of the country is projected to become hotter and drier, with less rainfall, higher temperatures and higher evapotranspiration likely to shift some currently arable land into rangelands.

Ceasing degradation, restoring degraded land and building soil carbon levels offers multiple co-benefits – increasing primary productivity and water use efficiency while potentially providing a climate change mitigation option and improving adaptive capacity. While inappropriate grazing has contributed to historical loss of soil carbon, there is strong anecdotal evidence that innovative grazing management can regenerate degraded land and build soil carbon. However, little research has been done and results are often contradictory.

This paper presents the preliminary results of a grazing study in south-eastern Australia comparing continuous grazing and rotational grazing using high stocking density, short stocking periods and long rest periods. Preliminary results show differences in pasture composition and response to rainfall between stocking methods, with higher total carbon and total nitrogen under rotational than continuous grazing to 65cm other than in the surface soil where continuous grazing is higher.

Presented Paper:

Dust Storms – What do they really cost?^A

P. Tozer and J. Leys

University of New England and NSW Office of Environment and Heritage
Email: John.leys@environment.nsw.gov.au

Abstract:

Much is understood about the physical aspects of wind erosion and dust storms; however, estimates of costs of dust storms are rare with very few studies being undertaken in the world. This paper summarises a study that was initiated to gain information on the scale of off-site costs of dust storms. The “Red Dawn” event of September 2009 caused disruptions to transport networks, and to commercial and domestic activities. Construction sites were closed, retail sales were reduced as shoppers remained indoors, and worker absenteeism was high as parents and carers remained at home due to perceived health and other risks, such as driving in poor visibility. Following the passage of the dust cloud, cleaning was needed at commercial and domestic sites as large amounts of dust were deposited in the path of the cloud. All of these activities and disruptions imposed costs on the state economy. An estimate of \$331 million is presented with the major component imposed on households due to cleaning premises and cars, and other associated costs. The results are used to estimate the cost-benefit of investment of soil erosion control on mitigation of off-site impacts. One of the problems identified in this study is the lack of Australian data, economic and physical, on the off-site impacts of dust erosion events. Recommendations include the need to resource the collection of data from households and businesses on the costs of these events, and a more accessible data source for the impacts on health of dust erosion events.

POSTERS

Session 2

- 1) Economic development in the rangelands through business technology.
Marion Murphy
- 2) Impact of future climate scenarios on pasture production and livestock enterprises in western NSW. *Trudie Atkinson*
- 4) Dust Watch - monitoring the interaction between climate and land management. *John Leys*

Poster:

**Economic development in the rangelands
through business technology.**

Marion Murphy

Email: marionmu22@gmail.com

Abstract:

A recent MLA study showed a return on investment of over 50% from the application of remote telemetry in western Queensland. This poster will illustrate and suggest the economic development possible through business technology, including remote telemetry, gamification, the use of mobile devices, cloud computing and data analysis.

Poster:

Impact of future climate scenarios on pasture production and livestock enterprises in western NSW.

Atkinson T.L^A and Smith W.J

NSW Department of Primary Industries, PMB 19, Trangie, NSW, 2823

^A Corresponding author. Email: trudie.atkinson@dpi.nsw.gov.au

Key words: climate change, pasture production and modelling.

Abstract:

This paper explores the impact of future climate scenarios on pasture and livestock production at five locations in western NSW. Outputs of climate and pasture models, simulating future pasture production are presented. The approach uses daily weather values, generated by downscaling historical data that statistically represent future climate as projected by four global circulation models (GCMs). These weather values are used in GRASP, with and without adjustments for increased atmospheric CO₂, to model pasture growth scenarios. The work explores the direction and feasible range of change and what it will mean for livestock production.

Poster:

Dust Watch – monitoring the interaction between climate and land management.

P. Tozer and J. Leys

University of New England and NSW Office of Environment and Heritage

Email: John.leys@environment.nsw.gov.au

Abstract:

Dust storms are the result of soil erosion by wind. They cause considerable damage both at their site of origin (e.g. the farm paddock, Leys and McTainsh 1994) and down wind as they deposit unwanted dust and reduce air quality (Chan et al., 2005). There are few actual estimates of monetary costs associated with dust storms. Huszar and Piper (1986) in the United States determined that the major off-site impact of dust erosion was on households, principally due to interior cleaning and domestic landscaping clean ups. Williams and Young (1999), in an initial study of the costs of dust in Australia, included the health costs, incorporating mortality and morbidity costs, of dust storms in South Australia and concluded that a major cost of dust in South Australia was caused by adverse health effects, particularly on the portion of the population that suffered from respiratory diseases, especially asthma sufferers.

Land use planning for multiple users and uses.

Session 3

Presented Papers:

- 1) Kimberley Regional Planning and Infrastructure Framework - accommodating aspirations of different land users and resolving conflicting demands for land.
Cate Gustavsson
- 2) WA Science and Conservation Strategy for Kimberley. *Daryl Moncrieff*
- 3) Balancing tradeoffs between biodiversity and production in the re-design of rangeland landscapes. *Cathy Waters*
- 4) A conservation planning framework for South Australia's arid lands.
Allen McIlwee
- 5) The Rangelands Reform Program: Implementing a plan for economic diversity in the Western Australian rangelands. *Hon. Wendy Duncan MLC*
- 6) Cattle, carbon, critters and culture - building a new rangelands. *Tim Wiley*

Presented Paper:

Kimberley Regional Planning and Infrastructure Framework – Accommodating Aspirations of Different Land Users and Resolving Conflicting Demands for Land.

Jackie Holm^A and Cate Gustavsson^B

^A Manager Planning Kimberley, Department of Planning
140 William St, Perth

^B Kimberley Principal Planner, Department of Planning
9 Napier Tce, Broome

Key words: Kimberley Regional Framework.

Abstract:

The Western Australia Planning Commission has established Regional Planning Committees across Western Australia over the last 5 years. These committees have a diverse membership including representation from State and local government, industry, Aboriginal groups and the community, and are tasked with preparing Regional Planning Frameworks.

These framework documents are a response to concerns expressed by the community, stakeholders and government (at all levels) for a stronger decision-making context across the regions, particularly the need for greater coordination of economic activity, infrastructure provision and land use. The frameworks investigate ways to encourage and facilitate population growth and economic development across WAs regions over the next 25 years by capitalising on regional comparative advantages and economic diversification.

The draft Kimberley Framework identifies an emerging range of land use pressures caused by new prospects in the agricultural and horticultural sectors, heightened interest in the region's mineral resources, and greater awareness of the potential for expanding the tourism industry. While these opportunities provide significant impetus for economic and population growth, each present challenges - ensuring that the region's unique natural environment is not diminished and recognising and incorporation of Aboriginal rights and interests. With Aboriginal people accounting for nearly half the current population and 50% of the Kimberley with determined Native Title, satisfying the aspirations of different land users in the Kimberley will be challenging.

Presented Paper:

WA Science and Conservation strategy for Kimberley.

Daryl Moncrieff

Regional Manager, Kimberley Region
Department of Environment and Conservation
PO Box 942
Kununurra WA 6743

Abstract:

The state government's \$63 million Kimberley Science and Conservation Strategy is a bold vision to ensure the long-term protection of the region's biodiversity. The strategy has a number of major themes, including: adding to the conservation estate through a formal reserve system (marine and terrestrial), developing conservation partnerships with neighbours and traditional owners, working with and employing local Aboriginal people and maintaining the Kimberley's rich culture, and providing opportunities for people to experience the Kimberley's natural and cultural wonders. One of the key objectives is to manage the north Kimberley in particular at a landscape scale, which entails working with traditional owners and pastoralists to deliver integrated fire, feral animal and weed management programs across multiple tenures.

Presented Paper:

Balancing tradeoffs between biodiversity and production in the re-design of rangeland landscapes.

C. Waters^{AE}, *T.D. Penman*^B, *R.B. Hacker*^A, *B. Law*^C, *R.P. Kavanagh*^{CD},
F. Lemckert^{CD} and *Y. Alemseged*^A

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Keywords: biodiversity, production.

Abstract:

The conflict that exists between the competing needs of biological conservation and those of pastoral production is well recognised, however, few studies examine these conflicts due to their complexity and the uncertainty that surrounds these relationships. We describe a process for the development of a Bayesian Network model that examines the trade-offs between the conservation value of the landscape for a range of taxa (flora, mammals, birds, herpetofauna) and the primary production value under alternative land-use. We identify regional vegetation context and structural complexity as key landscape drivers of biodiversity. Simple scenarios were used to examine the influence of alternative land use activities on multiple components of biodiversity and demonstrate how preferred landscape designs can be determined. The application of this model as a planning tool for land management agencies or regional NRM bodies to develop policy or direct future investment at multiple scales is identified.

Presented Paper:

A Conservation Planning Framework for South Australia's arid lands.

Allen McIlwee^{AE}, *Rob Brandle*^B, *John McDonald*^C, *Dan Rogers*^D, *Phil Pisanu*^D

^A Ecological Analysis & Monitoring Unit

^B Science Resource Centre (SRC)

^C South Australian Department for Environment

^D Water and Natural Resources (DEWNR)

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Abstract:

The Trans-Australia Eco-Link is a joint initiative of the South Australian and Northern Territory Governments, and aims to establish a 3,500 km corridor of connected landscapes from the Spencer Gulf to the Arafura Sea. Desired outcomes include the enhancement of sustainable property management initiatives such as EMU™, through partnerships with the pastoral community and NRM support agencies.

Determining the level of investment and support needed to maintain biodiversity across vast areas is difficult. In response to this challenge DEWNR has developed an information synthesis and evaluation process known as the "Landscape Assessment Framework" or LAF, which attempts to provide a systematic basis for landscape-specific conservation planning and priority setting across the arid zone.

The LAF is both an analytical and conceptual framework that seeks to define ecosystem components and ecological processes operating at landscape level (this requires a systematic process to name and identify plant communities that occur in distinct biophysical settings). The next, more difficult challenge is to document the dynamic processes that drive change within a landscape, allowing us to understand how systems vary in space and time. The last step in the LAF is to identify which components are most under threat, where and for what reasons? As such the framework provides a basis in which the merits and value of various stewardship programs can be debated and scrutinised.

We provide a set-by-step case study of the LAF, as applied to Witjira National Park and its surrounds in northern South Australia.

Presented Paper:

The Rangelands Reform Program: Implementing a Plan for Economic Diversity in the Western Australian Rangelands.

Hon. Wendy Duncan MLC

Parliamentary Secretary to the Minister for Regional Development; Lands.

Email: Wendy.Duncan@mp.wa.gov.au

Abstract:

The impetus for the Rangelands Reform Program arose from two reviews into the pastoral industry held in 2009 – the Southern Rangelands Pastoral Advisory Group’s A Review of the Economic and Ecological Sustainability of Pastoralism in the Southern Rangelands of Western Australia, and A Review of the Process to Permit Diversification on Pastoral Leasehold Land in Western Australia. The substantive findings of these two reviews were that traditional grazing enterprises continue to experience a long term decline in profitability and the condition of the Rangeland resource upon which they depend. Greater diversity of economic activity and land use offer the most realistic means of sustaining pastoralists and remote communities into the future but require expanded options in the tenure arrangements that govern Crown land in Western Australia. The intention of the Rangelands Reform Program is to establish these expanded tenure options to promote and facilitate economic development and preservation of the rangelands in the long term; streamline government processes and procedures that affect new business development; and identify region-specific economic development opportunities, while maintaining the social fabric and environmental sustainability of the rangelands. The Rangelands Reform Program will also assist with the development of the government’s vision for the rangelands.

A key action is to amend the Western Australian Government’s Land Administration Act 1997 (LAA) to provide options for new forms of tenure, such as a rangelands lease which will allow for broad scale and varied uses provided that use is consistent with the preservation and ongoing management of the rangelands. Together with the option of a perpetual pastoral lease and new diversification permit provisions, the key benefits will be greater flexibility, security and incentive for the pastoral industry and investment opportunities for new entrants.

Presented Paper:

Cattle, carbon, critters and culture – building a new rangelands.

Tim Wiley et al

Pilbara Coordinator, Rangelands NRM South Hedland, WA
Email: tijwiley2@bigpond.com

Abstract:

The current pastoral leases in WA are only for the purpose of grazing livestock. New tenures post 2015 may allow a wide range of land uses including livestock production, carbon offsets, biodiversity offsets and cultural uses. The challenge will be to integrate these new land uses into pastoral properties so as to capture the synergies from multiple enterprises in ways that strengthens the economic, environmental and social resilience of the rangelands. The ESRM process is being used to develop several stations in the Pilbara as pilots to demonstrate a new vision of land use that creates value from cattle production, carbon offsets, natural biodiversity and traditional indigenous culture.

POSTERS

Session 3

- 1) Western Innovators: A fresh approach to landholder capacity building in the Western Catchment of New South Wales. *Jennifer Sandow*
- 2) Can Conservation and Cattle Production co-exist? A Case Study: Toomba Station. *Megan Debney*
- 3) Mungalla – a case study of wetland restoration on Indigenous land. *D.M. Nicholas*
- 4) Locating the projects of improvement and production of the pasture using GIS (Case studies of Bande Ghora watershed in Kashmar). *Reyhane Azimi*
- 5) Looking after country. Implementation of the Kimberley Science and Conservation Strategy. *Amanda Moncrieff*
- 6) Integrated land and water planning in the Kimberley Region of Western Australia. *Kate Cole*

Poster:

**Western Innovators:
A fresh approach to landholder capacity building in
the Western Catchment of New South Wales.**

Jennifer Sandow

Western Catchment Management Authority,
Bourke, NSW

Key words: landholder mentoring, capacity building, socio-economic resilience.

Abstract:

Western Innovators is a mentorship program run by the Western Catchment Management Authority (CMA) which aims to support enterprise development and practice change being implemented by landholders living in the Western Catchment of far west New South Wales. This program has been established with the intention of providing landholders with a fresh form of capacity building and support to achieve improved natural resource management. The program also looks to establish a network of landholders to provide support in implementing practice change and assist in increasing the social capital of the participating landholders and in turn the social resilience. This paper will outline the process that the Western CMA undertook in implementing the program and explore the key elements of the program design. Discussions with mentees will also be used to form examples of the enterprise change and development being undertaken as a result of the program.

Poster:

Can Conservation and Cattle Production Co-exist? A Case Study: Toomba Station.

Megan Debney

Department of Agriculture, Fisheries and Forestry,
PO Box 976, Charters Towers Qld 4820

Key words: conservation, grazing, sustainability.

Abstract:

Is the use of rangelands for cattle production consistent with the conservation of natural habitat? The problem is discussed in the context of a case study of Toomba Station, a fully operational cattle property that has a history of conservation dating back to 1912 and a nature refuge agreement that was established in 2004. The balance between conservation and pastoral land use is achieved on Toomba by utilising recommended grazing land management (GLM) principles for sustainable land management. As a result of the case study it was concluded that the nature reserve successfully fits with the cattle operation on Toomba but may not be suited to all graziers in the area. Instead processes such as the Delbessie Agreement (State Rural Leasehold Land Strategy) and the Reef Protections Environmental Risk Management Plans (ERMPs) may be having a greater influence in increasing the uptake of GLM principles in the area.

Poster:

Mungalla – a case study of wetland restoration on Indigenous land.

D.M. Nicholas^{AC}, *Jacob Cassady*^B, *Anthony C Grice*^A

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Key words: rehabilitation, management, herbicide, Nywaigi.

Abstract:

North Queensland coastal wetlands have been severely degraded by the Weeds of National Significance (WoNS), *Hymenachne amplexicaulis* (Olive hymenachne) with lesser impacts by *Salvinia molesta* (Salvinia), and *Eichhornia crassipes* (Water hyacinth). Working with traditional owners, we are seeking to remediate a degraded wetland by improving the biodiversity of native plant and animal species, and improving water quality and the amenity value to the local community.

Mungalla Stud is a coastal cattle property east of Ingham in north Queensland. It incorporates coastal wetlands, grazing land and a coastal dune complex. The property abuts the Halifax Bay National Park and the Great Barrier Reef Lagoon. The property was purchased by the Nywaigi Traditional Owners in 2000. A management structure was created to run and manage the businesses associated with the property where by the land is owned by the Nywaigi Aboriginal Land Corporation and operated by the Mungalla Corporation for Business.

A concerted effort has been undertaken by the Nywaigi Traditional Owners to improve wetland habitats. They have partnered with CSIRO Ecosystem Sciences to undertake a range of activities to remediate the wetland to improve the function, hydrology and amenity value of the property. This has included aerial and ground based applications of herbicides, the strategic use of fire and revegetation of creek lines. This paper outlines the progress of the rehabilitation work undertaken by the Nywaigi traditional owners in collaboration with CSIRO and highlights the expectation that eradication of wetland weed infestations are difficult to achieve but control over large areas of weed infestations is possible.

Poster:

Locating the projects of improvement and production of the pasture using GIS (Case studies of Bande Ghora watershed In Kashmar).

Reyhane Azimi, Morteza Rezayi and Katayon Kazempor

Faculty of Natural Resources and Environment,
Ferdowsi University OF Mashhad, Iran

Key words: Arc Map, Arc View, locating the improved pasture project, seeding, saw, grazing management, Bande Ghora in Kashmar.

Abstract:

Mainly, Pastures of Iran are located in arid and semiarid regions. But according to local meteorological studies, Band Ghora in Kashmar has semi-arid and cold climate. 3 to 4 times utilization of the grazing capacity of the pastures in this basin is based on the type and percentage of of vegetation, slope and distance from water sources which led to the destruction of the pasture. The aim of the study is improving the rangelands (Desertified Rangelands or destroyed pastures), locating and upgrading the existing conditions with regard to the capabilities and limitations and relying on the existing state of the pastures, for improvement and reclaim operations such as: seeding, wet seeding, and grazing management using GIS techniques. Using topographic maps 1:50000, digital maps 1:25000, images derived from Google Earth software as well as field visits of the region, pasture land area was separated from other users. After that, the gradient maps, floor height, susceptibility to erosion, the rainfall, vegetation type and size and biological map of the region(bio-region) was prepared by putting digital maps in the software Arc Map, ArcView environment, the locate map of the suitable projects for improving pastures obtained. The result of the locate model of Kashmar's Bande Ghora, represents approximately 12.12 square kilometers (23.94 percent) of the surface area of the project of saw(ing), 2.7 kilometers (5.3 percent) of the project of seeding and 31.1 square kilometers (61.44 percent) of grazed watershed management project, is appropriate.

Poster:

Looking after country. Implementation of the Kimberley Science and Conservation Strategy.

Carolyn Thomson-Dans^A, Daryl Moncrieff^B and Amanda Moncrieff^C

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^C Program Coordinator, Landscape Conservation Initiative

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Abstract:

The Kimberley is a spectacular place, renowned for its natural and cultural significance as well as its raw beauty. It holds a special place for many people, locally, in Western Australia, Australia and across the world.

The state government's \$63 million Kimberley Science and Conservation Strategy, released in June 2011, is a bold vision to ensure the region's long-term conservation (see 'Protecting the Kimberley wilderness', LANDSCOPE, Summer 2011–12). The strategy has four major themes: conserving the Kimberley's unique natural environment; working with and employing local Aboriginal people and maintaining the Kimberley's rich culture; increasing knowledge to support informed decision-making, planning and management; and providing opportunities for people to experience the Kimberley's natural and cultural wonders.

A key objective of the Kimberley strategy is to manage the north Kimberley at a landscape scale (known as the landscape-scale conservation initiative). This means managing threats—such as fire, feral animals and weeds—cooperatively across property boundaries and in partnership with traditional owners and key stakeholders including pastoralists and the Australian Wildlife Conservancy (AWC), to increase the resilience of ecosystems across the whole landscape.

From the outset, the state government has been determined to ensure that the Kimberley strategy engages and involves people who live and work in the central and north Kimberley. For Aboriginal people, this approach has the potential to create employment opportunities, helping to maintain the rich culture of the Kimberley. Numerous government agencies, non-government organisations and Aboriginal communities across the state are now working together to make the vision a reality, bringing about better on-ground management of country through control of weeds and feral animals and through enhanced prescribed burning programs.

Poster:

Integrated land and water planning in the Kimberley region of Western Australia.

K. Gole, R. Cossart and S. Williams

Western Australian Department of Water, Kununurra, WA, 6743,
Corresponding author. Email: Kate Gole Kate.Gole@water.wa.gov.au

Abstract:

Integrated land and water planning in the context of Northern Australia requires an innovative approach that acknowledges the diversity of development drivers, indigenous and non-indigenous community aspirations for resource management and the generally data-poor state of knowledge about water resources. Within Northern Australia there is no such thing as a blank canvas for water planning– there is a complex array of people, issues, socio-politics, relationships, governance and overlapping process which define the planning landscape.

Through our experience in water planning in the Kimberley region of Western Australia, and ongoing discussion with stakeholders, we have developed a set of principles which guide our approach to planning. This approach requires planning to be flexible, underpinned by engagement and acknowledge the need to:

- ~ support existing planning processes
- ~ integrate planning initiatives
- ~ respect and support existing local and regional governance structures
- ~ be undertaken at a pace appropriate to community and stakeholders capacity to engage
- ~ integrate delivery of programs to maximise opportunities for engagement thereby ensuring planning is coupled meaningfully with on-ground activities.

This poster outlines these principles using examples from integrated land and water planning in the Kimberley region of Western Australia.

Livestock Production in the Australian Rangelands.

Session 4a

Presented Papers:

- 1) The livestock industry and its future in the Australian rangeland. *Mick Quirk*
- 2) Providing a diversity of management to achieve a greater plant diversity.
Angus Whyte
- 3) Seeking sustainable productivity improvements in the northern beef industry.
Leigh Hunt
- 4) Scaling grazing trial results upwards to a whole property level - a case study using Wambiana grazing trial. *Joe Scanlon*

Presented Paper:

**The livestock industry and its future
in the Australian rangeland.**

Mick Quirk

Paper unavailable at time of printing.

Presented Paper:

Providing a diversity of management to achieve a greater plant diversity.

Angus Whyte^{AC} and *Peter Jessop*^B

^A landholder Wyndham str. Wentworth NSW

^B Rangeland scientist DPI Dareton NSW

^C Corresponding author. Email: wyndham3@bigpond.co)

Abstract:

We have been using a rotational grazing system at Wyndham since late 2001, in that time we have increased our paddock numbers from 8 to 23 and have significantly improved our rotational system. We started keeping a "grazing chart" in 2002 and this has helped measure and guide us to improve our grazing management. In 2008 Peter Jessop (rangeland scientist) helped us establish 4 monitoring points across Wyndham to monitor indicators of our grazing management and progress towards a more productive and regenerative grazing system (sustainable not being good enough). The monitoring sites are assessed annually by Peter and myself together, providing a unique opportunity to interpret and discuss not only the changes we are seeing at the sites but rangeland management as a whole. At the conference the monitoring site data will be interpreted by Peter and me to provide two perspectives on what the data shows. I will also talk about the experience that we have had at Wyndham and the way our rotational grazing system has developed, this will include stock handling, fencing, waters and pest management.

Presented Paper:

**Seeking sustainable productivity improvements
in the northern beef industry.**

*Leigh Hunt^{AD}, Andrew Ash^A, Cam McDonald^A, Joe Scanlan^B, Lindsay Bell^A, Robyn Cowley^C,
Ian Watson^A, John McIvor^A and Neil MacLeod^A*

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^D Corresponding author. Email: Leigh.Hunt@csiro.au

Key words: beef enterprise modelling, beef production, sustainable development.

Abstract:

Economic pressures have challenged Australia's northern beef industry over the last decade. Productivity improvement has been slowing, costs of production have escalated rapidly and beef prices have not increased in real terms since 2004. Reversing these trends is imperative for a viable industry over the long term. We describe the approach we have taken in a new project that is exploring options for sustainable development of the industry as a basis for guiding research and development for the next 20 years. A range of development scenarios that offer potential to significantly improve profitability through productivity gains were developed in consultation with industry and technical experts. These scenarios are being assessed using a new simulation model of northern beef enterprises to explore their potential effects on productivity and economic and environmental outcomes in six regions.

Presented Paper:

Scaling grazing trial results upwards to a whole property level – a case study using the Wambiana grazing trial.

Joe Scanlan^{AD}, Neil MacLeod^B and Peter O'Reagain^C

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^B CSIRO Ecosystem Sciences, Dutton Park Q 4102.

^C Department of Agriculture, Fisheries and Forestry, Charters Towers Q 4820

^D Corresponding author. Email: joe.scanlan@daff.qld.gov.au

Abstract:

Grazing trials are used to quantify and demonstrate the biophysical impact of grazing strategies, with the Wambiana grazing trial being one of the longest running trials in northern Australia. Previous economic analyses of this trial suggest that there is a major advantage in stocking at a fixed, moderate stocking rate or in using decision rules allowing flexible stocking to match available feed supply.

The present study developed and applied a modelling procedure to use data collected at the small plot, land type and paddock scale at the trial to simulate the property-level implications of a range of fixed stocking rates for a breeding-finishing enterprise. The best economic performance was achieved at a moderate stocking rate of 10.5 adult equivalents/100 hectares. Model outcomes are consistent with previous economic analyses using actual trial data.

Further modelling of the Wambiana trial data is warranted and similar analyses should be applied to other major grazing trials to allow scaling up of results to the whole-property level.

Impacts of climate and grazing pressure on livestock production systems.

Session 4b

Presented Papers:

- 5) Sustainable development of VRD grazing lands. *Steve Petty*
- 6) Nutritional wisdom at work in a grazing enterprise. *Nan Bray*
- 7) Long term effects of different grazing strategies on productivity profitability and land condition in a variable climate. *Peter O'Reagain*
- 8) Optimising capital investment and operations for the livestock industry in Northern Australia. *Ian Watson*

Presented Paper:

Sustainable development of VRD grazing lands.

*Steve Petty*², *Leigh Hunt*¹, *Robyn Cowley*³, *Alaric Fisher*⁴, *Andrew White*^{2,6}, *Neil MacDonald*³, *Matthew Pryor*⁵, *Andrew Ash*¹, *Kieren McCosker*³, *John McIvor*¹ and *Neil MacLeod*¹

1 CSIRO Ecosystem Sciences

2 Northern Development Company

3 NT Department of Regional Development, Primary Industry, Fisheries and Resources

4 NT Department of Natural Resources, Environment and the Arts

5 Observant Pty. Ltd

6 The University of Queensland.

Key words: Intensification, Grazing Distribution, Sustainable Development.

Abstract:

This project investigated the potential for pastoral intensification in the Victoria River District (VRD) of the NT to increase the profitability of the northern beef industry in the face of rising costs. The results suggested that intensification can increase a property's profitability without adverse effects on land condition or biodiversity in the short term. The keys to this are the use of sustainable pasture utilisation rates and appropriate development of paddocks and water points. Grazing management based on set pasture utilisation appeared to be the most profitable grazing system. The use of advanced technologies such as telemetry to manage water points can offer improvements in efficiency and cost savings. About half the properties in the VRD have the potential for intensification because they currently operate with pasture utilisation rates below the recommended 20%. Intensification of these properties could see an increase in cattle numbers in the VRD of about 154,000 AE, generating an additional annual gross margin of about \$17m. The project identified a series of guidelines for the sustainable development of properties and also a number of recommendations for the protection of biodiversity under pastoral intensification.

Presented Paper:

Nutritional Wisdom at Work in a Grazing Enterprise.

Nan Bray

Dragon Point Enterprises, P.O. Box 20, Oatlands TAS 7120
nan.bray@bigpond.com www.dragonpoint.com.au

Abstract:

A 4-year trial incorporating concepts of nutritional wisdom into a wool-growing grazing enterprise has resulted in a number of positive, and often unexpected, changes in the production system. Nutritional wisdom is the ability of livestock to learn from their mothers, and from individual experience, to graze the foods they need to balance their diets naturally, and to self-medicate: to reduce intestinal parasites, for example. In order to put these concepts into practice, the stocking rate was reduced substantially, to ensure sufficient quantity of diverse forage, and ewes and lambs were run in family groups, rather than year-classes. Family group management means that lambs are allowed to wean themselves, while remaining with their mothers to learn nutritional wisdom. The resultant improvements in the production system include a 27% increase in total lambing rate and increases in wool cut per sheep of 40% in ewes and 23% in lambs. Drenching rates dropped dramatically, to only two drenches of lambs and no drenches of ewes between October 2008 and February 2012. In combination, these changes resulted in higher profitability at lower stocking rates, with improved ecological integrity in the production landscape. Changes in flock dynamics were also observed, with a much higher level of social cohesion and predator-deterrence behaviour.

Presented Paper:

Long term effects of different grazing strategies on productivity, profitability and land condition in a variable climate.

Peter O'Reagain and John Bushell

Agri-Science Queensland,
Department of Agriculture, Fisheries and Forestry,
Charters Towers. Q4820.
Corresponding author. Email: peter.o'reagain@daff.qld.gov.au

Key words: stocking rate, spelling, flexible stocking.

Abstract:

Inter-annual rainfall variability is a major challenge for sustainable and profitable grazing management in northern Australia. Results are presented from a large, 13 year grazing trial on the relative performance of five stocking strategies in managing for rainfall variability. Strategies are compared in terms of their impacts upon animal production, profitability and pasture condition. The results show that recommended strategies such as moderate stocking, varying stock numbers in response to forage availability and moderate stocking with wet season spelling are not only more sustainable, they are also far more profitable than heavy stocking. It is suggested that managers apply some form of flexible stocking around long term carrying capacity with stock numbers changed in a risk-averse manner as rainfall varies between years. Some form of wet season spelling also appears important to maintain pasture condition.

Presented Paper:

Optimising Capital Investment and Operations for the Livestock Industry in Northern Australia.

Andrew Higgins^A, Ian Watson^B and Chris Chilcott^C

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Phone: +61 7 3224 6415

Key words: transport, infrastructure, optimisation, northern Australia, beef.

Abstract:

Despite the northern beef industry's longevity, scale and importance, recent disruptions to external markets have demonstrated a degree of industry vulnerability to supply chain shocks. Matching the industry's long-evident resilience to climatic variability with resilience to changes in markets and supply chains will require careful planning and investment in logistics. This paper provides an outline of a new project, funded by a collective of northern Australian Governments, to provide the northern beef industry and related stakeholders (e.g. state and federal governments) with tactical and operational dynamic models of industry logistics along the supply chain from farm gate through to export port. A valuable novelty of the model is the high granularity of individual vehicle movements and the ability to scale up to a holistic view of logistics costs across the entire northern industry. This enables an iterative examination of how changes in logistics infrastructure could result in improved efficiency and increased productivity that, in turn, suggest further possible changes in infrastructure investment and operations under different market scenarios. This project is one of a suite of projects that support beef and allied industry development across northern Australia.

POSTERS

Session 4

- 1) Understanding the preference of cattle for shade and water. *G.J. Bishop-Hurley*
- 2) Prediction of feed intake in growing beef cattle fed tropical forages.
Luciano A. González
- 3) Agroforestry for sustainable goat farming: shade, shelter, fodder and environmental benefits of trees. *Marwan El Hassan*
- 4) The Devil is in the Detail - managing feral goat grazing at breeding sites for the endangered Malleefowl *Leiopoa ocellata*. *Milton Lewis*
- 5) Diet selection and digestive efficiency of Dorper sheep and farmed goats and their implications for natural resource management in western NSW.
Yohannes Alemseged

Poster:

Understanding the preference of cattle for shade and water.

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Key words: environmental protection, GPS, automated animal control.

Abstract:

Natural resource management (NRM) groups have been co-funding the removal of cattle from riparian zones by installing fences and off-stream watering points. Riparian areas provide not only a source of drinking water but also a source of shade and fodder, thus it is not clear how important each of these are. Early work has shown that providing access to off-stream water (e.g. a trough) reduced the amount of time cattle spent in riparian areas by up to 80%, implying that access to water is a major reason why cattle frequent the riparian area but not the sole reason. The objective of this experiment was to compare cattle activity in areas where shade and water are co-located, shade and water are located separately and where water is present without shade to investigate their preference for shade and water. The experiment was conducted at Belmont Research Station (150° 13 E, 23°8 S), located 20 km NW of Rockhampton. Water trough and/or shade structure combinations were randomly positioned in the paddocks. Initially, three groups of ten Brahman steers (*Bos indicus*) were fitted with GPS collars and assigned to one of the three paddocks. All three groups of cattle were moved between the three paddocks during the period from October 2011 to January 2012. Cattle were observed from a distance regularly and had ad-libitum access to grazed forage and trough water throughout the experiment. Preliminary results from the experiment are presented and the implications of these results on riparian zone monitoring work discussed.

Poster:

Prediction of feed intake in growing beef cattle fed tropical forages.

Luciano A. González, Carlos Ramírez-Restrepo, David Coates and Ed Charmley

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Key words: feed intake, model, tropical forages.

Abstract:

Prediction of feed intake in beef enterprises is important for feed budgeting, productivity, profitability and environmental outcomes (e.g. carbon and methane accounting). The objective of this study was to develop empirical prediction models for feed intake of growing beef cattle fed a range of tropical forages. Data were gathered from previous metabolism and pen trials (76 treatment diets) having live weight (LW), dry matter intake (DMI) and diet characteristics including in vivo DM digestibility (IVDMD), nitrogen (N), neutral (NDF) and acid (ADF) detergent fibre. Prediction equations of DMI were derived using mixed-effects linear regression models with LW and diet characteristic as independent variables and location of trial as a random factor. The models were later validated with an independent dataset from published literature related to tropical grazing trials. Results indicated that DMI could be predicted with similar accuracy using LW and any one measure of diet characteristic (R^2 from 73 to 81%) with the highest R^2 from the equation based on LW and ADF. However, validation against an independent dataset from grazing trials indicated that DMI was more accurately predicted from LW and IVDMD ($R^2 = 75\%$), LW and N ($R^2 = 71\%$), LW and NDF ($R^2 = 61\%$), and least with LW and ADF ($R^2 = 24\%$). The lower accuracy of the models to predict DMI from grazing trial may be due to diet selection and method used to measure it. The present models may be used with results from faecal NIRS as input to predict DMI more accurately.

Poster:

Agroforestry for sustainable goat farming: shade, shelter, fodder and environmental benefits of trees.

Marwan El Hassan and John Field

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Key words: agroforestry, goats, shade and shelter.

Abstract:

The establishment of trees on farms provides shade and shelter for grazing livestock. Many trees and shrubs are also important feed sources, especially during periods of pasture scarcity. In addition, agroforestry provides many environmental benefits to farm ecosystems. All these factors suggest a vital role for trees in sustainable farming systems, especially in the context of climate change. This research focusses on the benefits of agroforestry to goat farming in Australia, a particularly important and growing industry given the increasing global demand for goat meat and Australia's lead role in world exports. There is significant potential for goats in silvopastoral systems, given their hardiness, adaptability, and tendency to browse on plant material that is not usually consumed by other stock. This project includes two major experiments: one investigates the effect of shelter provision on the growth and performance of newborn nursing kids (0-3 months old); and the second investigates the effects of shade provision, supplementation with fodder from acacias and willows, and potential interactions between these two factors on the productivity and performance of weaned kids (3-6 months old). Productivity parameters, such as live weight changes, control of internal parasites, and feed intake, will be used in the analysis. This study will lead to a better understanding of the roles that trees and shrubs play in sustainable goat farming, and will also result in well-tested recommendations to the goat industry, to optimally establish and design goat farms by incorporating trees and shrubs in the landscape.

Poster:

The Devil is in the Detail - Managing feral goat grazing at breeding sites for the endangered Malleefowl *Leipoa ocellata*.

Milton Lewis^{AD}, *Angus Arnott*^B and *Angela Higgins*^C

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Key words: exclusion fencing, Mallee fowl, pest animal management.

Abstract:

Surveys by the Lachlan Catchment Management Authority have mapped the locations of isolated breeding groups of endangered Malleefowl *Leipoa ocellata*. These populations occur within highly specific mallee vegetation that are rare within the general mallee woodlands of the western Lachlan catchment. Direct browsing competition between goats *Capra hircus* and Malleefowl has created a difficult dilemma in balancing conservation outcomes and maintaining income for landholders. In addition to installing a network of 56 water point goat traps, the Lachlan Catchment Management Authority has developed a landscape scale fencing method of passively removing feral goats from critical breeding habitat. Vegetation monitoring sites indicate that removal of high density browsing has positive vegetation outcomes for maintaining critical Malleefowl breeding habitat. In the long-term this new innovative use of strategic fencing to create a system of controlled traffic to reduce the impact of goat grazing in habitats of high conservation value while reducing landholder management costs will make goats profitable under most financial situations yet promote biodiversity of fragile western habitats.

Poster:

Diet selection and digestive efficiency of Dorper sheep and farmed goats and their implications for natural resource management in western NSW.

Y. Alemseged, R.B. Hacker, I.D. Toole, W.J. Smith and C. Waters

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Abstract:

The recent introduction of new sheep breeds such as the Dorper and the increasing trend to farming feral goats, pose serious questions for the ecological sustainability of the semi-arid and arid rangelands of western New South Wales. While Dorper sheep offer important production advantages, little is known from Australian research about their grazing habits and management requirements from a natural resource perspective. Similarly, the knowledge base on goat management in rangelands is limited to their control as a pest or their use in controlling some woody species and little attention has been directed to their management as livestock. This paper reports on a project that aims to evaluate the diet selection and digestive efficiency of Dorper sheep and farmed goats and their likely impact on the environment compared to Merino sheep. Possible opportunities and risks due to the introduction of these species are discussed. Grazing management strategies will be developed based on the findings.

Functioning of rangeland ecosystems from site to landscape.

Session 6a

Presented Papers:

- 1) Strengthening scientific research and management across northern Australia through Indigenous rangers and community collaboration. *Rebecca Dobbs*
- 2) Revegetation with Australian native grasses - a reassessment of the importance of using local provenances. *Wal Whalley*
- 3) Ecosystem Management Understanding (EMU) TM: Building landscape literacy to rehydrate the rangelands of South Australia. *Janet Walton*

Presented Paper:

**Strengthening scientific research and management
across northern Australia through Indigenous rangers
and community collaboration.**

R. Dobbs^A, R. Cossart^B, P. Close^A and P. Davies^A

^A Centre for Excellence in Natural Resource Management, University of Western Australia,

^B Western Australian Department of Water, Kununurra, WA, 6743

Key words: Waterways Education, Indigenous engagement, Natural Resource Management

Abstract:

Sustainable natural resource management (NRM) requires research and planning to be complemented by strong community engagement and input. This is especially true in northern Australia where the Indigenous and community level values may not directly align with national, state or regional NRM objectives or priorities. The Waterways Education Program (WEP) provides opportunities for enhancing local community knowledge and participation in NRM, by training Indigenous rangers in remediation actions and monitoring techniques for rivers and wetlands. The program has increased the capacity of Indigenous rangers to monitor and manage their water resources as part of a broader approach to landscape scale conservation and management focusing on the impacts of weeds, ferals and changing fire regimes. We present two WEP case studies highlighting the benefits of increasing the capacity of local communities to input and engage in NRM. This collaborative approach provides a template for future initiatives and programs, aiming to strengthen community engagement.

Presented Paper:

Revegetation with Australian native grasses – a reassessment of the importance of using local provenances.

R.D.B. (Wal) Whalley^{AD}, *Ian H. Chivers*^B and *Cathy M. Waters*^C

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Key words: provenances, local, inbreeding.

Abstract:

Many restoration guidelines strongly recommend the use of local sources of seed in native plant revegetation projects. These recommendations are based on assumptions that the species used for revegetation are cross-pollinated and woody, and were originally developed for overstorey vegetation in the northern hemisphere. We challenge their validity with respect to replacing or enhancing the native Australian grass component of degraded rangelands. Firstly, obligatory cross pollination has not been recorded in any Australian native grasses except for a few dioecious species. Indeed the majority of Australian native grasses so far studied have revealed complicated breeding systems that provide flexibility allowing reproduction and genotypes to be matched to the variable Australian environment. Secondly, we argue that the genetic dissimilarity among populations of a species is not proportional to the distance between them but is more related to the environmental stresses that have been placed on those populations in the past. We therefore conclude that there is little justification for the recommendation that only local sources of seed of Australian native grasses should be used particularly for large-scale revegetation programs. We provide some general guidelines for deciding on the seed sources to use depending on the purpose of the revegetation and characteristics of the species of choice.

Presented Paper:

**Ecosystem Management Understanding (EMU)™:
building landscape literacy to rehydrate the rangelands
of South Australia.**

*Participants and staff of the EMU™ Projects in South Australia
(Janet Walton ^A, Hugh Pringle ^B and Col Stanton ^C)*

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Key words: Trust, Empathy, Attitude

Abstract:

Bringing about positive change and the wise use of rangelands is more about enabling landholders to enhance their knowledge and build their skills rather than bringing modern science to “teach”. Pastoralists across the South Australian Arid Lands (SAAL) Natural Resources Management (NRM) Region, have embraced the Ecosystem Management Understanding (EMU)™ approach because it values and blends their local knowledge with scientific expertise in a conducive environment. Through participating in the EMU™ Projects, land managers have shifted their focus from trying to resurrect dysfunctional landscapes typified by exacerbated landscape droughting to key problems jeopardising their most productive and healthy country. This is a very different approach to that conventionally used in the Decade of Landcare and promoted by administration bodies at the time. Here we present a succinct and general review of EMU™ in South Australia from 2009 to today.

Assessment and monitoring of impacts on rangeland ecosystems.

Session 6b

Presented Papers:

- 4) Designing new monitoring programs for Mulga woodlands - lessons learned from the Pilbara. *Gerald Page*
- 5) The impacts of grazing land management on the wind erodibility of the Mulga Lands of western Queensland, Australia. *Helene Aubault*
- 6) Microclimate and soil properties of older bilby diggings at Lornas Glen rangelands restoration project. *Tamra Chapman*

Presented Paper:

Designing new monitoring programs for Mulga woodlands - lessons learned from the Pilbara.

Gerald FM Page^A and Pauline F Grierson

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Key words Acacia aneura, linear infrastructure, grazing impacts.

Abstract:

Mulga woodlands and shrublands are distributed across ~ 20 % of the Australian continent and are one of the dominant vegetation types of the semi-arid zone, with a long history of pastoralism. More recently, Mulga woodlands have been subject to increasing pressures from other landuses, including expansion of the mining industry and development of regional infrastructure. There is a pressing need for improved design and implementation of monitoring systems in Mulga woodlands and shrublands that are capable of attributing any detected changes in their composition, structure and function to anthropogenic impacts. We discuss some of the shortcomings of much of the current monitoring using examples from recent reviews and highlight the importance of designing monitoring systems that can relate cause and effect rather than simply observing change. We also highlight critical considerations for the design of future monitoring programs including, but not limited to, terrain features and soils, natural processes including fire and flood, stand demographics and composition, management history and the importance of redundancy/robustness in the design. Furthermore, we demonstrate how the power of a monitoring program can be improved through comparisons with other datasets, highlighting the importance of data standards and procedures among projects.

Presented Paper:

**The impacts of grazing land management
on the wind erodibility of the Mulga Lands of
western Queensland, Australia.**

Helene Aubault^A, Nicholas P. Webb^B, Craig L. Strong^C, Joe C. Scanlan^C, John F. Leys^D

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Key words: wind erosion, land degradation, management, GRASP, stocking rate, modelling.

Abstract:

An estimated 110 Mt of dust is eroded by wind from the Australian land surface each year, mainly originating from the arid and semi-arid rangelands. Livestock production is thought to increase the susceptibility of the land surface to wind erosion by reducing vegetation cover and modifying surface soil stability. However, research is yet to quantify the impacts of grazing land management on the erodibility of rangelands, or determine how these impacts vary between land types. We present a simulation analysis that links a pasture growth and animal production model (GRASP) to the Australian Land Erodibility Model (AUSLEM) to evaluate the impacts of stocking rates and stocking strategies on the erodibility of the Mulga Lands in western Queensland, Australia. Our results show that adopting conservative and flexible stocking rates, that enable managers to maintain land in good condition can help reduce the susceptibility of the Mulga Lands to wind erosion.

Presented Paper:

Microclimate and soil properties of older bilby diggings at Lorna Glen rangelands restoration project.

Tamra F. Chapman

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Abstract:

This study investigated the microclimate and soil properties of three year old bilby (*Macrotis lagotis*) diggings at ex-pastoral Lorna Glen Station (Mutawa), in central Western Australia. Microclimate conditions were milder and less variable in diggings than on undisturbed soil, particularly at night. Relative humidity was also more stable in large volume diggings than small volume diggings at night. Soils from the bottom of the diggings were significantly higher in ammonium and nitrate, exchangeable potassium and magnesium and total cation exchange capacity than undisturbed soil. Greater soil fertility in diggings may be explained by a number of processes operating alone or in combination. First, removal of the nutrient deficient surface soil by bilbies exposes the more fertile sub-soil. Second, given that the diggings were around three years old, accumulation and mixing of litter and soil, including that transported from the de-compacted spoil mounds, may have increased soil fertility. Third, the milder and less variable microclimate conditions in diggings may facilitate nutrient mineralisation via litter breakdown and the activity of soil fauna and fungi. Finally, exchangeable nutrients may be released in pulses during periodic alternate wetting and drying of the soil; a climatic pattern typical at Lorna Glen. This study has shown that bilbies increase heterogeneity of soil microclimate, fertility and compaction. The milder microclimate and greater soil fertility in diggings may potentially benefit plant germination and productivity and fauna seeking to use diggings as refuges and habitats.

POSTERS

Session 6

- 1) AusPlots-Rangelands progress after two years. *Andrew White*
- 2) Drought induced death of bladder saltbush *Atriplex vesicaria* in the north east pastoral district of South Australia. *Craig Boulderstone*
- 3) The importance of long-term flora monitoring across Australia's Rangelands. *Ben Winter*
- 4) Atmospheric nitrogen and carbon transformed by cyanobacteria contribute to productivity in pastoral rangelands. *Bruce Alchin*
- 5) The influence of grazing management and total grazing pressure fencing on ground cover and floristic diversity in the semi-arid rangelands. *Cathy Waters*
- 6) AusPlots-Rangelands: Survey progress in the Northern Territory. *Emrys Leitch*
- 7) Water ponding on Larrawa station, November 2011: a photo story. *Matthew Fletcher*
- 8) Sustainability and Degradation. An unresolved conflict for low productivity rangeland. *John Stretch*
- 9) Development and implementation of a field based data entry system (FDE) used in land condition monitoring of pastoral leases in the South Australian rangelands. *J. Maconochie*
- 10) Does wet season spelling improve land condition? *Paul Jones*
- 11) Power of a photo. *Ray Thompson*
- 12) Water spreading to restore native grasslands. *Kevin Mitchell*
- 13) Microclimate and soil properties of older bilby diggings at Lorna Glen rangelands restoration project. *Tamra F Chapman*

Poster:

AusPlots-Rangelands progress after two years.

I.A. White, J.N. Foulkes and B.D. Sparrow

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Key words: Australian rangelands, biodiversity survey, AusPlots.

Abstract:

AusPlots-Rangelands developed and is implementing continental scale, plot-based biodiversity survey and sampling methods for rangelands bioregions. The plot data provides consistent, quality baseline data for soils and vegetation accessible through the TERN Eco-informatics portal, with the ability to track future changes and include additional biodiversity information.

The method has stand-alone modules investigating soils (to 1 m with multiple samples in each plot for carbon, bulk density, nutrient and metagenomic analyses), vegetation (plant vouchers for inclusion in herbaria and leaf samples for DNA and isotope analyses) and cover. The modules use accepted methods (e.g. point intercept) and have developed innovative ways to: collect data (a field data collection app to minimise data double handling); track data (scanned sample barcodes); and describe plots (3D plot photo panoramas and searchable images). Integral to AusPlots-Rangelands are collaborations with TERN facilities and wider e.g. universities, herbaria, National Soil Archive, Beijing Genomics Institute, BioPlatforms Australia. Survey training plus a detailed survey manual (downloadable at www.tern.org.au/ausplots) ensures data consistency.

Methods were developed collaboratively with numerous relevant stakeholders: state, territory and federal governments; universities; national bodies; conservation organisations; land managers; NRM groups, practitioners etc. Diverse participants and their varied agendas, time and resources limitations, all produced challenges necessitating compromise. Nonetheless, the method provides valuable information for varied disciplines, as well as fulfilling the needs of state and territory governments, conservation groups and land managers.

Surveys commenced in late 2011 (NT), early 2012 (NSW, SA) and late 2012 (WA, Qld) with a target of 700 permanent plots across the rangelands. AusPlots-Rangelands is part of TERN (Terrestrial Ecosystem Research Network) a national science research infrastructure project.

Poster:

Drought induced death of bladder saltbush *Atriplex vesicaria* in the north east pastoral district of South Australia.

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key words: *Atriplex vesicaria*, drought, mortality.

Abstract:

Bladder saltbush (*Atriplex vesicaria*) is used extensively as an indicator of land condition in chenopod shrublands in South Australia. It is palatable, long lived, drought tolerant and its occurrence is widespread over a wide range of soil types. In recent years the SA Pastoral Lease Assessment Program has commonly found widespread mortality at rates in excess of 90% for this species and while this is just one facet used to assess land condition, it is important to understand if this is primarily due to management or climatic conditions. An area in the Barrier Ranges Outwash IBRA subregion, consisting of five paddocks covering 161 km² was monitored in 2011. This area had been voluntarily destocked by a land manager since prior to the summer of 2001. Density transects in both the ungrazed and grazed areas were examined and found to have mortality ranging from 98% to 99% in both stocked and unstocked areas.

Adjusted rainfall data and models of 'Growth' developed by Australian Grassland and Rangeland Assessment by Spatial Simulation (AussieGRASS) (<http://www.longpaddock.qld.gov.au/>) are examined in data modelled back to 1890. The number of consecutive years of low 'growth' from 2001 to 2009 is of the order of that in the severe droughts of the 1960's, 1930's and 1890's. This suggests that despite resilience of bladder saltbush to drought, a threshold has been passed where most shrubs have not survived and this has occurred even in the absence of grazing pressure.

Poster:

The importance of long-term flora monitoring across Australia's Rangelands.

Ben Winter

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Key words: rangeland, monitoring, flora.

Abstract:

Flora monitoring throughout the Australian rangelands has been intrinsically linked to rangeland management throughout grazing history. Although this monitoring is often carried out daily on an informal scale by land managers, broadscale monitoring that attempts to capture long-term change has been the responsibility of government departments. The Rangeland Assessment Program (RAP) has been monitoring 163 sites across the Western Catchment of New South Wales (NSW) since 1989. During this time valuable data has been collected from across the Catchment generating information on biomass changes, species mixes, groundcover and woody species dynamics. This data is provided to landholders throughout the Catchment on an annual basis.

Whilst data has been collected over the past 22 years, little has been done to liberate this data for state-wide reporting requirements. This paper seeks to outline the importance of data liberation of long term flora monitoring throughout Australia's rangelands, using the Rangeland Assessment Program as a case study. These trends will become an important part of setting management targets for the Western Catchment's looming Catchment Action Plan (CAP) reporting requirements.

Poster:

Atmospheric nitrogen and carbon transformed by cyanobacteria contribute to productivity in pastoral rangelands.

B.M. Alchin^{AB} and W.J. Williams^A

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Abstract:

The importance of biologically fixed nitrogen and carbon by cyanobacterial soil crusts in grazing ecosystems was assessed on several pastoral holdings across northern Australia. The broad aim of this research is to assist graziers in refining pasture management in relation to seasonal increases in soil nutrients. Increased plant-available nitrogen in the soil-plant ecosystem flows through to livestock productivity gains. Survey and sampling showed cyanobacterial crusts were an important ecosystem component across all sites. N-fixing species of cyanobacteria were identified and preliminary data showed that continuous grazing and cell grazing had significantly different levels of plant-available nitrogen, total nitrogen and carbon associated with the presence of cyanobacterial soil crusts. Rangeland sustainability depends on the renewal of carbon and nitrogen stocks and these results indicate different grazing systems may affect these important resources.

Poster:

The influence of grazing management and total grazing pressure fencing on ground cover and floristic diversity in the semi-arid rangelands.

C. Waters^{AC}, *G. Melville*^A, *A. McMurtrie*^B, *W. Smith*^A, *T. Atkinson*^A and *Y. Alemseged*^A

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Key words: ground cover, biodiversity, grazing management.

Abstract:

The contribution of non-domestic grazing pressure to pastoral areas of western NSW has been reported to increase grazing intensity by at least 50%. Any control of these external grazing pressures will increase the capacity for landholders to manage and restore pastoral areas. The use of total grazing pressure (TGP) fencing to enhance ground cover is assumed but as yet unproven. This paper describes the preliminary results of a study that is assessing the impact of TGP fencing in combination with alternative grazing management on ground cover and floristic diversity in western NSW. Two management systems - 'TGP fencing with rotational grazing' and 'non-TGP fencing with set stocking'- were contrasted using a series of paired sites in similar landscapes. Non-TGP fencing with set stocking resulted in less than half the floristic diversity and almost twice the proportion of bare ground compared with TGP fencing and rotational grazing. These preliminary results suggest that both catchment targets of maintaining 40% ground cover and increased biodiversity can be achieved by combining rotational grazing with control of total grazing pressure.

Poster:

AusPlots-Rangelands: survey progress in the Northern Territory.

Emrys Leitch^{AB} and *Rick Flitton*^A

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Key words: biodiversity surveys, permanent plots, Australian rangelands.

Abstract:

AusPlots-Rangelands is establishing permanent surveillance plots throughout the Australian rangelands to assess baseline stocks and condition of vegetation and soils at a continental-scale and collect a wide range of plant and soil samples for downstream analysis. This is achieved in partnership with local jurisdictions through surveys using a set of standardised methods and sample collections at replicated plots within significant bioregions. AusPlots-Rangelands is part of TERN (Terrestrial Ecosystem Research Network), a national science research infrastructure project.

The Northern Territory surveys commenced in September 2011, refining the methods to be implemented across Australia. Over 85 plots have been surveyed in southern NT bioregions (Finke, Central Ranges, Burt Plain and MacDonnell Ranges) and the Gulf Fall and Uplands in the northern NT. 150 NT sites should be established by the end of 2012.

So far, over 5,000 plant specimens have been collected and identified, over 6,800 plant samples have been collected for DNA barcoding and isotope analysis. Soil profiles have been described at each site and 2,670 soil samples collected for inclusion in the CSIRO National Soil Archive. Additionally, 657 soil metagenomic samples have been collected, the first significant collection in the NT.

Collaborations have been established with other parts of TERN i.e. Supersites at Ti Tree and Calperum, AusCover (remote sensing) and TERN Soils, as well as cooperation with conservation groups, pastoral companies and Indigenous groups, representing significant advances in cross-disciplinary cooperation. The poster will present preliminary data on vegetation and soils and downstream analysis of samples.

Poster:

Water ponding on Larrawa station, November 2011: a photo story.

Matthew Fletcher^A, Kevin Brockhurst^B, Melanie McDonald^C and Ray Thompson^D

^A Department of Agriculture and Food WA, Kununurra

^B Larrawa station, Halls Creek WA

^C Rangelands NRM WA, Broome

^D Central West Catchment Management Authority, Nyngan NSW

Key words: water pond, grader and cost.

Abstract:

The poster presents a photo story of works completed on Larrawa station in the Kimberley region of Western Australia during November 2011. This producer demonstration began in November 2009 to demonstrate the practicalities of rehabilitating severely degraded pastoral land. The efficacy of the different rehabilitation techniques to provide groundcover after one wet season varied considerably with open water ponds built in November 2011 proving to be the most effective method of establishing groundcover.

Open water ponds were constructed using a Caterpillar model 16G and a model 12G grader. Both machines built water ponds to the same set specification. The 16G machine was more economical, building one 210 m long water pond at a cost of \$67 compared to \$102.90 for the 12G machine.

The cost to rehabilitate one hectare with a 16G machine was \$148.52. This included the construction of two 210 m ponds, two rips (50 m long) on the inside of each pond to roughen the soil surface, and seeding with forage sorghum seed (Sweet Jumbo) at 2 kg per ha.

Two Range Condition Monitoring sites were installed in 2011. At the time of reassessment in 2012 no improvement in land condition was recorded, however an increase in groundcover was observed a sign of improved ecological function.

Key knowledge gained

- ~ A 16G was more economical than a 12G to build water ponds – won more dirt per pass.
- ~ Surveying for ponds is best completed by a professional experienced in surveying ponds.
- ~ An experienced machine operator is essential to get full value out of 'machine hire'.

Poster:

**Sustainability and Degradation.
An unresolved conflict for low productivity rangeland.**

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Key words: Rangeland, profitability, degradation.

Abstract:

The biological productivity of Western Australia's rangeland is shaped by climate, climate variability and history. From the early days of pastoral settlement an ill founded expectation fueled unsustainable rates of exploitation. The earliest settlement tended to be concentrated in productive pasture close to easily exploited water source. As water infrastructure was extended, the reach of the industry encompassed extensive less productive area.

Passage of the 1997 Land Administration Act marked paradigm shift, when the Pastoral Lands Board of Western Australia became obliged for the first time to promote pastoral leases with stand alone 'grazing business viability' and with 'ecological sustainability'.

East and west Kimberley example is presented where severe range degradation was reversed prior to 1997 although tellingly, in each case the catalyst committing government to action was not the deterioration in land capability. Meat and Livestock Australia published Northern Cattle Industry research findings in 2010 to remind us that government's goal of Grazing Industry sustainability is still more aspiration than reality in the Pilbara, Kimberley and elsewhere across northern Australian rangeland.

A rational process of rangeland property restructure will be needed, for the industry-sustainability and the benign environmental goals of the 1997 LAA to be realized.

Poster:

Development and implementation of a field based data entry system (FDE) used in land condition monitoring of pastoral leases in the South Australian rangelands.

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Key words: data entry, field tablets.

Abstract:

In an effort to streamline the monitoring of pastoral leases in South Australia the Department of Environment, Water and Natural Resources (DEWNR) Pastoral Unit has developed and implemented the use of a field based data entry system (FDE). The system comprises specifically designed software and field rugged hardware, significantly reducing time taken in the field for Pastoral Lease Assessments and Inspections and eliminating the laborious task of office data entry. Additional benefits include reduced reporting times, greater accuracy through validation of data at the site, greater accuracy and timeliness of map edits, considerable time saving in navigation and site relocation and significant reduction in paper used. It also means scientific staff spending a greater proportion of their time doing what they have trained for and less time on administrative level tasks.

Poster:

Does wet season spelling improve land condition?

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Key words: spelling, condition, composition.

Abstract:

This project seeks to improve the evidence base and modelling capacity underpinning recommendations for use of wet season spelling to recover poor condition grazing land and design more reliable and cost-effective spelling options for producers across northern Australia. There is limited experimental work or expert knowledge on spelling strategies to improve or maintain land condition (McIvor 2011). Site 1 has a study on the key combinations of timing, duration and frequency of spelling within a grazed 'C' land condition paddock in Central Queensland for a five year period. Site 2 will be established in the 2nd year of the project at the Wambiana grazing trial in northern Queensland on 'C' land condition sites subject to moderate and heavy grazing. Data from field trials will be used to improve the capacity of GRASP to simulate the impacts of different spelling and stocking rate regimes on pasture conditions over a range of pasture community types and seasons. The project will engage with producers and field staff at each site. Site 1 has had variable rainfall over the previous decade with predominantly dry or very dry conditions. Good growing conditions, prior to and during the first two summers of recordings have resulted in high pasture yields and crown cover. Pasture yields have been high for both *Bothriochloa ewartiana* and *Aristida* spp. While there has been a small improvement in land condition overall, there has been minimal impact so far from the spelling strategies applied compared to the continuously grazed control.

Poster:

Power of a photo.

Ray Thompson

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Key words: monitoring, waterponding, rehabilitation.

Abstract:

Yearly monitoring of a Waterponding site in the Nyngan district for seven years has given encouraging results. Bare scalded semi-arid areas in western New South Wales are being transformed into biodiverse native pastures, thanks to the waterponding technique which is returning clear profit to the landholder and benefits to the environment.

This paper highlights the dramatic landscape change through the Power of a Photo that has taken place after the waterponding rehabilitation technique has been applied to scalded duplex soils.

Poster:

Water spreading to restore native grasslands.

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Key words: waterspreading, environmental, invasive native scrub, land management, soil carbon.

Abstract:

Waterspreading is a land rehabilitation technique that targets the variability of rainfall and runoff in semi-arid systems to initiate long term changes in ground cover. This study outlines the effect of waterspreading at 'Florida' in western NSW, which has been steadily implementing waterspreading systems for the last 30 years. By combining recent pasture measurements, on-farm observations, and soil surface carbon and nitrogen measurements, this study outlines the dramatic changes in pasture condition and diversity, and long term changes in surface soil properties, that occur following waterspreading. These dramatic yet persistent changes exemplify the benefits of implementing rehabilitation that is based upon the processes that govern resource movement and productivity within semi-arid systems, namely, recognition of variability in rainfall and runoff, and management of this.

Poster:

**Microclimate and soil properties of older bilby diggings
at Lorna Glen rangelands restoration project.**

Tamra F Chapman

Department of Environment and Conservation.

Abstract:

For rangeland areas that have been set aside for conservation, ecosystem processes can be restored by re-introducing native fauna that dig while foraging. This study investigated the microclimate and soil properties of three year old bilby *Macrotis lagotis* diggings in Western Australia's goldfields.

Fire management in a carbon economy.

Session 7

Presented Papers:

- 1) Fire management in a new rangelands economy: making sense of research, policy and on ground implementation. *Jeremy Russell-Smith*
- 2) Optimising fire management in grazed tropical savannas. *Robyn Cowley*
- 3) The effect of fire frequency and patch dynamics on soil carbon fluxes in tropical rangelands. *Diane Allen*
- 4) Above and below ground carbon dynamics of different fire regimes in extensive grazing systems in northern Australia. *Leigh Hunt*
- 5) Carbon opportunities to benefit the rangelands economy - a landholder perspective.

Presented Paper:

Fire management in a new rangelands economy: making sense of research, policy and on-ground implementation

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Key words: carbon farming, diversification, savanna burning.

Abstract:

Savanna burning contributes between 2-4% annually to Australia's greenhouse gas emissions accounts. However, fire is a natural process and a key land management tool in the northern Australian rangelands. Fire is used to control woodland thickening, improve pasture production and quality, control weeds and manage habitat for biodiversity conservation. In recent times there has been a concerted attempt to move away from complete fire suppression and its consequence: frequent, high intensity wildfires late in the dry season. In fire-adapted vegetation types, prescribed early dry season fires have the advantages of providing an effective management tool for reducing the incidence of late season wildfires and generating less greenhouse gas emissions. However such a fire regime, in combination with grazing, may result in undesirable levels of woody vegetation thickening. The emergence of a carbon economy in Australia hints at the opportunity for pastoral land managers to diversify their enterprises by adopting fire management practices which reduce greenhouse gas emissions and increase longer term sequestration into living biomass. This opportunity comes at a time when the economic performance of the northern pastoral industry is suffering. In order to realise benefits from a new rangelands economy, we need to identify and address the gaps in scientific knowledge, current policy settings and implementation to optimise the conservation, production, emissions and economic outcomes.

Presented Paper:

Optimising fire management in grazed tropical savannas.

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Key words: fire management, grazing, tropical savannas.

Abstract:

Fire is an integral component of tropical savannas, but is often actively excluded from commercially grazed systems in northern Australia. The Kidman Springs Fire Trial (Victoria River District, NT), established in 1993, assessed the impact of fire management on woody cover and pasture condition. The trial is replicated on calcarosol and vertosol sites, with grazed experimental plots burnt early or late in the dry season, every two, four and six years, as well as unburnt controls. On calcarosols four-yearly late season fires were required to manage woody cover, whereas on vertosols, four-yearly early or late burns were adequate. Two-yearly fire or early dry season fire increased the proportion of dicots and suppressed the increase of perennial grass yield through time on the calcarosols; and on the vertosols, two-yearly or early fire increased annual grass yield but decreased total yield. Bio-economic modelling of a commercial cattle station found that implementing four-yearly fire improved animal production and enterprise profits, with late season fire providing the greatest benefits. There was an opportunity cost of implementing early season fire (as recommended for carbon and biodiversity outcomes) of \$85/km² compared to burning later in the year.

Presented Paper:

The effect of fire frequency and patch dynamics on soil carbon fluxes in tropical rangelands.

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Abstract:

Soil respiration is the major source of CO₂ flux to the atmosphere in terrestrial systems. In tropical rangeland ecosystems disturbance regimes, such as cattle grazing and fire, impact soil CO₂ fluxes and therefore, carbon stored in the soil. In this study we measured soil respiration in grazed experimental plots burnt every two, four and six years, as well as unburnt plots and a grazing exclosure at the Kidman Springs long-term fire experiment established in tropical woodlands of northern Australia. We tested the influence of patch type (grass vs. tree-dominated), soil temperature and soil moisture on soil respiration at the end of the wet season. We describe and quantify how fire and grazing influence soil respiration by altering soil physical conditions and vegetation patch dynamics. We conclude that changes to fire regimes and grazing intensity in tropical rangelands could have a large impact on soil carbon cycling.

Presented Paper:

**Above and below ground carbon dynamics
of different fire regimes in extensive grazing systems
in northern Australia.**

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Key words: carbon modelling, carbon stocks, prescribed fire.

Abstract:

This paper reports initial field studies and modelling of carbon stocks under alternative fire regimes in northern rangelands. The field studies in the Victoria River District suggested that fire regime had no effect on aboveground carbon stocks (AGC) in an open grassland/shrubland. In an open Eucalypt woodland the overall effect of fire season was not significant and the effect of fire frequency was inconsistent. However, modelling suggested that regular burning to maintain low woody density and promote grass production will reduce above- and below-ground carbon stocks in the open woodland. The opportunities for pastoralists to increase carbon stocks by reducing fire frequency are limited in many regions and will depend on vegetation type and current fire regime. Any carbon gains are likely to be modest and will be associated with greater tree and shrub density, which may adversely affect pasture and livestock production.

Session 7

Presented Paper:

Carbon opportunities to benefit the rangelands economy - a landholder perspective.

Authors

Paper unavailable at time of printing.

POSTERS

Session 7

- 1) The effects of fire on grazed Mitchell Grass pastures in the East Kimberley: a case study. *Andrew Craig*
- 2) Early wet season burning and pasture spelling to improve land condition in the Victoria River District (NT). *Dionne Walsh*
- 3) Developing and implementing policy for fire management of invasive native scrub in New South Wales. *P. Droulers*
- 4) Stacks of Fire - Implementing a Fire Management Program Mount Isa Mines. *Kate Masters*
- 5) Improving landholders' knowledge of fire as a management tool within the Burdekin rangelands. *Olivia Pisani*

Poster:

The effects of fire on grazed Mitchell Grass pastures in the East Kimberley: a case study.

Andrew B. Craig^A and *David J. Hadden*^B

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Key words: Mitchell Grass, fire, grazing.

Abstract:

Mitchell Grass pastures are valued for their high carrying capacity and traditionally there has been some reluctance to use fire in their management. The effects of fire in a cattle grazing context were documented on Flora Valley station, in the East Kimberley region of Western Australia.

Two sets of sites (0.13 ha), paired on either side of an access track, were established within each of two 'black soil' paddocks. These were subject to normal station management. Plant frequencies were monitored in most years over 1995-2010, using a protocol similar to that for grassland sites in the Western Australian Rangeland Monitoring System (WARMS). Pasture composition and total standing dry matter (TDSM) were also estimated.

The number of fires at individual sites varied from one to seven; timing of fires varied from August to November. Most had no detectable effect on the frequency of two key perennial species – *Astrelba pectinata* (Barley Mitchell Grass) and *Chrysopogon fallax* (Ribbon Grass). Ribbon Grass frequency increased over the study at five of six sites where it was initially recorded. At one site, a reduction in Ribbon Grass frequency following a small-scale fire appeared to be associated with heavy post-fire grazing. There was some evidence that fires in one year may have reduced the subsequent frequency of Flinders Grass (*Iseilema vaginiflorum*), a useful annual. Values of TSDM at sites burnt in the previous year were extremely low in two years with below average wet-season rainfall, highlighting the need for careful assessment of risks when planning fire management for these pastures.

Poster:

Early wet season burning and pasture spelling to improve land condition in the Victoria River District (NT).

Dionne Walsh^{AD}, *Sam Crowder*^B, *Boronia Saggars*^B and *Suzanne Shearer*^C

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Key words: savanna burning, cattle, 3P grasses.

Abstract:

A new trial investigating wet season spelling (with and without early wet season burning) to improve land condition commenced on Delamere station in the Victoria River District (VRD) in 2010. The site is situated on productive "black soil" country that supports the native grass *Dichanthium fecundum* (Curly Bluegrass). Curly Bluegrass is a resilient and productive perennial grass which grows on heavier soils across northern Australia. It is valued for pastoral production but declines under constant heavy grazing. The previous manager of Delamere had noticed that the vigour and seed production of this and other valuable pasture grasses was enhanced by burning early in the wet season followed by rest from grazing. The trial is thus comparing spelling (with or without burning) at two- and three-year intervals to determine which regime will be the most practical and effective way to improve land condition, pasture productivity and seed production.

Poster:

Developing and implementing policy for fire management of invasive native scrub in New South Wales.

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Abstract:

Invasive native scrub (INS) has caused major changes to landscapes in Western NSW with adverse effects on pastoral production and aspects of biodiversity. The reduction in the incidence of fires since European settlement has contributed to these changes. The priority for managing INS is to maintain open areas and reduce further increase of invasive native species density. Effective management of INS will result in a mosaic of native vegetation types in the landscape creating a diversity of habitats. The control of INS has benefits for production and the environment with improved native groundcover and soil stability. The management of total grazing pressure (TGP) before and after burning is crucial to achieving improved environmental and production outcomes.

The most cost effective way to manage INS is the control of seedling germination events with fire. Mass seedling germinations occur following prolonged high rainfall events and there is a limited window of opportunity to manage the seedlings. Seedlings of many invasive native species are susceptible to fire with almost one hundred percent kill rate when they are less than thirty centimetres in height. The kill rate with fire dramatically decreases with plants above thirty centimetres and negligible above fifty centimetres height. Although fire has limitations in managing INS it is considered to be the only realistic tool to manage seedlings at a landscape scale.

Effective policy is required to ensure that appropriate fire regimes are encouraged and that balanced environmental outcomes are achieved. This paper discusses how these policies are implemented in NSW and the optimal fire management to maintain mosaic landscapes with the control of INS.

Key message: Effective policy is required to allow management burning of Invasive Native Scrub seedlings to maintain a landscape mosaic in Western NSW.

Poster:

Stacks of Fire - Implementing a Fire Management Program Mount Isa Mines.

K. Masters

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Key words: planning, communication, controlled burning.

Abstract:

How does a mine site environmental advisor convince a mine manager to let them light a fire within a few hundred meters of two fresh air intakes of an underground mine, a 320 man camp and a massive crushing facility construction project? Letting them play with a drip torch helps but getting it right with the right project planning and people and then not disrupting production is the best method. The 66 640km² Mount Isa Inlier bioregion in north western Queensland is typified by rugged red rocky hills, low open woodland of spinifex and snappy gum and is the location of the Xstrata Mount Isa Mines copper, lead and zinc open cut and underground mining and processing/smelting operations. A biodiversity assessment conducted in 2009 identified that wildfire was a significant threat to the biodiversity of the 32,000ha Mining Lease. Other research including habitat and distribution surveys of the fire sensitive Carpentarian and Kalkadoon grasswrens found that wildfires were extensive across the bioregion and threatening these species. Xstrata Mount Isa Mines developed a lease wide Fire Management Plan with the inclusion of neighbouring pastoral properties to implement hazard reduction and infrastructure protection. The first round of the on ground burning program was successfully completed in March 2012 with six strategic burn areas. Parameters that attributed to the high rate of success with this program included no mine shut downs or production interference during the burns and a high degree of stakeholder involvement including neighbouring pastoral property managers; scientifically sound burning techniques including weather conditions for cool burns and ratio of area burnt / unburnt allowing for increased habitat regeneration and retention.

Poster:

Improving landholders' knowledge of fire as a management tool within the Burdekin rangelands.

Olivia Pisani & Bob Shepherd

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PO Box 976, Charters Towers, QLD, Australia

Key words: grazing; woodland thickening; extension.

Abstract:

There has been a reduced use of fire as a management tool in grazing systems within the Burdekin rangelands since the wet years of the 1970's. Several severe droughts and the adverse effects of wildfire have resulted in a negative perception of the role of fire as a management tool. The reduced frequency of fire has contributed to a decline in some 3P grasses, an increase in woody weeds and a change in woodland structure. As a result land condition has deteriorated causing a reduction in carrying capacity for beef production. In November and December of 2011 QDAFF ran five fire management information days on host properties within the Burdekin catchment to outline the role of fire and its importance in land management. In total, the information days were attended by 56 beef producers representing 54 properties covering an area of 1,728,738 ha, two national parks employees and two employees from local mines. Four members from Queensland Fire and Rescue also attended to provide information on fire safety and regulatory aspects. Producer feedback indicated 51% of attendees felt they could make more use of fire to improve their pasture management, with 92.9% feeling more informed to make decisions about the use of fire as a result of participating in the day.

The fire management information days are part of a larger extension program to improve the management of beef enterprises in the Burdekin catchment.

Policy development and implementation in rangeland.

Session 8

Presented Papers:

- 1) Re-imagining Western Australia's degraded southern rangelands through knowledge based redevelopment planning. *Rod Safstrom*
- 2) Mesquite management in the NSW rangelands; A history of policy, management and landholder's perceptions. *Matt Goulton*
- 3) Implications of alternative feral goat management strategies for natural resourcemanagement policies in NSW rangelands. *Salahadin Khairo*
- 4) A national approach to building resilient rangelands. *Kate Forrest*

Presented Paper:

Re-imagining Western Australia's degraded southern rangelands through knowledge-based redevelopment planning.

Rod Safstrom ^A, Tony Brandis and PJ Waddell

^A Department of Agriculture and Food WA

Abstract:

This paper is designed to stimulate further dialogue for a restoration and ecologically sustainable usage approach for Australia's rangelands, focussing on the natural resources of the southern rangelands of Western Australia. A brief statement on the current economic, environmental, social and governance situation is provided. Vast areas of the southern rangelands are now considered degraded, with ongoing degradation, and many areas economically un-viable. Destocking, closing water points, strategic on ground works and favourable seasonal pulses are needed for recovery. Social adaptations to this situation include: increasing stocking beyond sustainable levels, diversification, work off station, resorting to Centrelink payments, and sale to government and private conservation interests. The paper describes a land use planning approach underpinned by our knowledge of land systems and land capability analysis across the majority of leases. Social, economic and environmental criteria can then be used spatially to map areas with common characteristics. A number of pathways for intervention for different social, economic and environmental permutations are documented and could be tailored to fit landscapes with common characteristics. Opportunities include:

- ~ Enforcement of the ecologically sustainable management provisions in the LAA Act.
- ~ Incentives including modified lease conditions and payments for landscape recovery.
- ~ Purchase of leases by conservation interests or government.
- ~ Development of diversification and carbon farming opportunities.

The paper provides an avenue for rethinking, redirection and revitalisation of the southern rangelands and highlights the funding, governance and restoration challenges which need to be investigated to underpin the land use planning process outlined.

Presented Paper:

Mesquite management in the NSW Rangelands; A history of policy, management and landholder's perceptions.

Matt Goulton

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Key words: mesquite; management; community.

Abstract:

Mesquite (*Prosopis spp.*) is a Weed of National Significance and is declared in New South Wales under the Noxious Weeds Act 1993 (Class 2). Infestations of mesquite occur in far western NSW in varying densities over an area of approximately 680,000 ha within 3 discrete management zones to the north (200km), west (<30km) and south east (150km) of Broken Hill.

The Western Catchment Management Authority has invested considerable funds in mesquite management in the region since its inception in 2005, as have previous government agencies and departments over the last 30 or so years.

This paper will explore the history of the dynamics of relationships between government led initiatives and the legislative framework surrounding mesquite over this period and the impact this has had on landholder's perceptions and attitudes towards weed management and their role in containing this weed.

Further, the paper will aim to compare these observations with the corresponding growth in both the density and extent of mesquite infestations within the region, with the aim of exposing where the legislative framework and government led control initiatives may have failed or could be improved upon.

The paper will examine three levels of evidence to suggest that community-driven initiatives offer the greatest chance of success in controlling invasive plant species. These include; a qualitative survey of land managers (farmers) and NRM managers (government agencies) and a review of previous government and private (landholder driven) initiatives in the region; a quantitative evaluation of the actual extent of mesquite within the region, comparing age classes of untreated individuals and evidence of previously treated 'parent' trees and; external case studies from other regions within Australia that have taken different approaches to managing pest plants with an emphasis on community involvement.

Presented Paper:

Implications of alternative feral goat management strategies for natural resource management policies in NSW rangelands.

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Key words: economics, feral goat, policy, NSW

Abstract:

This paper presents a brief summary of an economic analysis of alternative feral goat management strategies (no control, opportunistic harvesting, value added and goat-proof fencing) and their implications for natural resource management policies in NSW rangelands. Opportunistic and value added strategies are profitable for landholders. The profitability of investment in goat proof fencing to support livestock production could be comparable to current goat management practices if moderate increases in carrying capacity can be achieved through improved grazing management. Financial incentives that are based directly on measured resource condition (e.g. ground cover) and encourage investment in exclusion fencing and improved management would be preferable to incentives supporting goat harvesting activities. These activities are not necessarily favourable to resource conservation as they are driven by goat price rather than population and are, in any event, profitable for landholders. A 'no control' strategy has adverse economic consequences for pastoral properties.

Presented Paper:

A national approach to building resilient rangelands.

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Key words: Collaboration, National, Rangelands

Abstract:

The National Rangeland NRM Alliance (The Alliance) is a collaboration of 14 rangelands natural resource management bodies representing some 81 per cent of Australia's landmass.

The Alliance is leading the development of the Australian Rangelands Initiative (ARI) to highlight the importance of productive and resilient rangelands. The ARI is a collaboration with rangeland organisations, agencies, land managers and interest groups working together to ensure the ARI encompasses national issues.

The ARI targets two key result areas:

1. Building the national rangelands agenda to create awareness of the importance of Australia's rangelands and a commitment to implement the 'National Principles for Sustainable Resource Management in the Rangelands'.
2. To demonstrate how this can be achieved by targeting groundcover as a driver of soil leaving the landscape, biodiversity and carbon storage.

POSTERS

Session 8

- 1) Balancing ecological and environmental objectives in smoke management planning. *Carolyn E. Blocksome*

Poster:

Balancing ecological and environmental objectives in smoke management planning.

Carolyn E. Blocksome^A, Tom Gross^B and Douglas Watson^C

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Key words: smoke management, prescribed burning, tallgrass prairie.

Abstract:

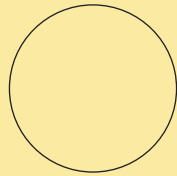
Prescribed burning is a rangeland management technology used world-wide for a variety of management objectives. The Flint Hills region of Kansas and Oklahoma represent the largest contiguous area of the remaining tallgrass prairie ecosystem in North America. Each year approximately two and one-half million acres of largely privately-owned prairie in this region experiences a prescribed burn during the month of April (Mohler and Goodin 2012). Late spring burning has been shown to achieve both ecological and economic objectives with a single burn.

This concentrated period of burning has contributed to air quality non-attainment in nearby cities where air quality monitors are located. Urban and regulatory concerns about the contribution of prescribed burning smoke resulted in the development of the Kansas Flint Hills Smoke Management Plan. The plan acknowledges the need for prescribed burning in maintaining the tallgrass prairie ecosystem, and includes minor regulations and a largely voluntary program for reducing non-attainment in urban areas.

During the summer and fall of 2010, regulators chose to utilize a collaborative approach to formulating a smoke management plan. Urban, rural, and wildlife interests were represented on the committee that formulated the plan. Following approval of the plan in December 2010, an extensive outreach campaign was initiated to inform the public and encourage voluntary compliance with the plan. Three non-attainment events related to smoke from prescribed burns were recorded in urban areas of Kansas in April 2011. Burn bosses indicated they knew about the plan but burned additional acres due to fear of increased regulations in the future.

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