

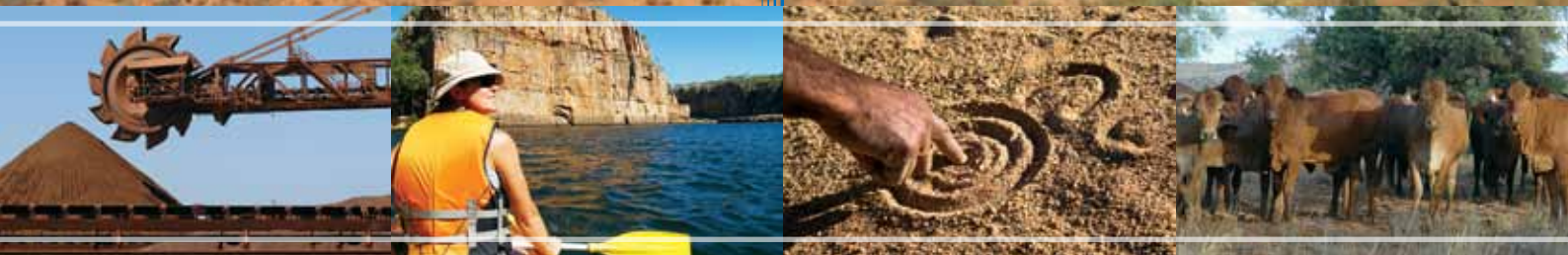


Australian Rangeland Society 18th Biennial Conference

Alice Springs Northern Territory
12 - 16 April 2015

www.arsconference.com.au

Innovation in



the Rangelands



**Australian Rangeland Society
18th Biennial Conference**

Alice Springs Northern Territory
12 - 16 April 2015

www.arsconference.com.au



Foreward

Welcome to the 18th Biennial Conference of the Australian Rangeland Society in Alice Springs. The Organising Committee has worked tirelessly to ensure you have a most rewarding experience after travelling all the way to the Red Centre of Australia. This year's theme "Innovation in the Rangelands" focuses on how rangeland people have adapted to the challenges of living productively in our rangelands environment where climate extremes, remote urban decision making and small isolated communities are common. We have also looked at innovative ways of presenting the conference without losing the essence of this wonderful society established in 1974.

Alice Springs is the geographical heart of Australia, also described by locals as "the town closest to every beach in Australia". Straddling the ephemeral Todd River, Alice is set in the midst of the beautiful MacDonnell Ranges. The various land systems in central Australia provide the pastoral industry with pasture types that vary from highly preferred flood outs, open woodlands and calcareous shrubby grasslands, to less useful mulga and spinifex country.

The town and its surroundings are on traditional Aboriginal land with activities such as pastoralism, mining, tourism, biodiversity conservation, recreation and government service all part of what happens on the surrounding rangelands. Apart from a rich Aboriginal cultural history there are sixth generation pastoral families producing cattle off the land.

Four exciting field trips have been arranged to provide an overview of the scenery, land systems, lifestyle and economic activity in and around Alice, before getting into the conference presentations. The Hon. Fred Chaney, together with the other distinguished keynote speakers, will set the scene for lively discussion in seven broad topic areas involving more than 50 platform with a further 50+ poster presentations. Posters will be formally presented to ensure their full value is added to the conference.

We want to thank our sponsors whose generous support assisted to keep the registration cost of the conference within reason, while still presenting a quality conference which has become synonymous with the Society.

This 18th Australian Rangeland Society Conference was made possible through the efforts of a dedicated Organising Committee, highly efficient conference organisers ' Meeting Masters' and the ongoing support of the ARS Council.

Enjoy the conference and experience the hospitality of the Alice.



Pieter Conradie

Chair

ARS 18th Biennial Conference Organising Committee

TABLE OF CONTENTS

Committee Members	7
Acknowledgements	7
Sponsors	Back Cover
Program	8

ABSTRACTS

18th Australian Rangeland Society Conference: "Innovation in the Rangelands"

SESSION 2

Leadership and relationships

12

SPOKEN PAPERS

Keynote: What's in a name? Making Australians care about the Outback
Barry Traill 12

Investigating options for innovation in investment and policy models for rangelands
Kate Forrest & Andrew Drysdale 13

Working together to improve knowledge and understanding of climate change in the Australian rangelands
Mary-Anne Healy et al. 14

Innovation systems for food security in rangeland margins, sub-Saharan Africa
Jocelyn Davies et al. 15

A multi-disciplinary approach to research for the development of northern Australia
Ian Watson et al. 16

Developing an appropriate telecommunications strategy for remote Australia
Broadband for the Bush Alliance 17

Preparation of a research plan for natural resource management in northern Australia
Gabriel Crowley et al. 18

POSTER

The Cooperative Research Centre for Remote Economic Participation: A mid-term update
Steve Blake & Kevin Williams 19

SESSION 3

Pastoral management

20

SPOKEN PAPERS

Keynote: Rangeland pastoralism: change and sustainability
Phil Holmes 20

Adaptive capacity on the rangelands
Nadine Marshall & Matthew Curnock 21

Extensive beef stocking rate strategies for coping with rainfall variability
Lester Pahl et al. 22

Ahead of the pack: what 30 years of commercial pastoral innovation can teach us
Dionne Walsh 23

Adding a new string to the bow of Indigenous pastoral businesses
Jane Tincknell & Jo-Anne Craig 24

Collaborative Area Management
Catherine Crowden 25

Understanding wild dog predation dynamics in an Australian arid zone pastoral region
Steve Eldridge et al. 26

'Rangeland Self Shepherding' – positively influencing grazing distribution to benefit livestock, landscapes and people
Dean Revell et al. 27

From concept to reality – developing new technology in remote Australia
Sally Leigo et al. 28

Are we there yet? Tracking state and change in Australia's rangelands
Gary Bastin et al. 29

The NRM Spatial Hub – underpinning better management decisions in the rangelands
Michael Digby et al. 30

Innovation in

POSTERS

- Preference of range plant species as assessed by pastoralists' perception and actual empirical determinations in a semi desert area in Sudan
Mohammed Abdelkreim & Babo Fadlalla _____ 31
- Dorper sheep in southern Australian rangelands: production success or environmental concern?
Yohannes Alemseged et al. _____ 32
- Impact of grazing management on ground cover and domestic stocking rate under Holistic Management
Yohannes Alemseged et al. _____ 33
- VegMachine® in Queensland
Terry Beutel et al. _____ 34
- Using business analysis to inform management decisions in beef businesses
Kiri Broad et al. _____ 35
- (Student). Assessment of rangeland degradation caused by *Opuntia*-invasion in semi-arid zones of South Africa, implications on grazing strategies, carbon sequestration and agricultural land values
Lukas Chipfupa et al. _____ 36
- Abnormal reproductive observations for beef cows on arid rangelands, associated with suspected increase in dietary phytoestrogens
Jocelyn Coventry et al. _____ 37
- What distance from water should we use to estimate paddock carrying capacity?
Robyn Cowley et al. _____ 38
- (Student). Dynamics and distribution of grazed patches under different stocking strategies in tropical savanna rangelands
M.H. Dekkers et al. _____ 39
- 'RANGEWATCH': An NDVI based method of estimating forage biomass in northern Australia. A case study in the western Kimberly region of Western Australia
Graham Donald et al. _____ 40
- Improving performance through adaptive grazing: Beetaloo Station
Jane Douglas et al. _____ 41
- Wet season spelling: a producer demonstration site
Carly Harris et al. _____ 42
- What determines recruitment success of trees on pastoral land in SE Australia?
Ken Hodgkinson et al. _____ 43
- Burdekin rangelands Grazing BMP and Extension support project – practice change
Melissa Holzwart et al. _____ 44
- Expanding the range of control options for *Calotropis procera* (rubber bush) in the Barkly Tablelands
Meg Humphrys et al. _____ 45
- Spelling strategies for recovery of pasture condition
Paul Jones et al. _____ 46
- A diary of a new bore:
Helen McMillan et al. _____ 47
- Quality Graze trial: grazing strategies impact on land condition and premium beef production in central Australia
Chris Materne _____ 48
- Welcome to the journey – finding the production answers with the producers
Chris Materne & Jane Tincknell _____ 49
- Achieving greater pastoral profit
MLA and AWI _____ 50
- Economic impacts of rehabilitating degraded lands in the Burdekin catchment
Timothy Moravek & Trevor Hall _____ 51
- Burdekin Grazing BMP and extension support project – a cost benefit analysis
Timothy Moravek & Brigid Nelson _____ 52
- Fifty years of monitoring pastoral lands in central Australia – the Cunningham sites
Camilla Osborn _____ 53
- How well does NDVI correlate with green biomass, cover and diet quality?
David Phelps et al. _____ 54
- Potential for innovations in pastoral management, ecological recovery and governance in the Nullarbor region of Western Australia
Rodney Safstrom & Paul Novelty _____ 55



**Australian Rangeland Society
18th Biennial Conference**
Alice Springs Northern Territory
12 - 16 April 2015
www.arsconference.com.au

TABLE OF CONTENTS

Operator bias associated with visual assessments of pasture yield for forage budgets on native pasture Nicole Spiegel et al. _____	56	Managing the cumulative impacts from CSG water extraction in the Surat Basin, Queensland Randall Cox et al. _____	69
Expansion of the exotic grass <i>Bothriochloa pertusa</i> on the Basalt of the Burdekin catchment Raymond Stacey _____	57	Understanding environmental condition for the strategic adaptive management of Lake Eyre Basin waterways Dale McNeil & David Schmarr _____	70
Best Management Practice, a benchmarking process for the grazing industry Michael Taylor & Peter Long _____	58	Non, je ne regrette rien: what do four years of LEBRA monitoring tell us? David Schmarr et al. _____	71
Application of remote sensing for mapping and monitoring rangeland condition Dan Tindall et al. _____	59	One river - many journeys: fish and drought refuges in the Finke Angus Duguid et al. _____	72
Cattle grazing found to have had no negative effect on soil carbon stocks at a site in the Northern Territory Dionne Walsh & Peter Shotton _____	61	Reading the signs: Arabana, water and country Melissa Nursey-Bray _____	73
Palatable forbs less prolific than presumed on a black soil site in the Victoria River District Jodie Ward & Dionne Walsh _____	62	(Student). Degraded or just dusty? Examining 150 years of ecological change in inland eastern Australia Jen Silcock & Rod Fensham _____	74
Developing a regional incentive for retaining rangeland ground cover Cathy Waters et al. _____	63		
The influence of managing grazing intensity on soil organic carbon and biodiversity Cathy Waters et al. _____	64		
Impacts of pasture spelling on the performance of a beef grazing property in northern Australia Giselle Whish et al. _____	65		
Stocktake Plus App optimises Grazing Best Management Practices (BMP) for managing grazing pressure Megan Willis _____	66		
Ecosystem Management Understanding (EMU™), a landscape approach to rangeland management Kenneth Wright & Hugh Pringle _____	67		
SESSION 4: Water Sharing	68	SESSION 6 Communication	75
SPOKEN PAPERS		SPOKEN PAPERS	
Rangeland Journal Lecture: Challenges for sustainable water management in the rangelands Stuart Bunn _____	68	Aboriginal people choose new media for an old practice Fiona Walsh et al. _____	75
		Western Arrarnta Seasonal Chart Else Kennedy et al. _____	76
		Building on the knowledge of the Aboriginal land managers of tomorrow Meg Mooney _____	77
		Using eExtension to enable change in the rangelands John James _____	78
		"Australian Outback: Heart of a Continent" Alun Hoggett _____	79
		POSTERS	
		Communicating natural resource management projects in the rangelands of WA Teresa Belcher _____	80

Adventures with video – practical tips and tricks on sharing your story
Rod Campbell _____ 81

The Rangelands Partnership: information to spur innovation in rangeland research, education and practice
Jodee Kuden et al. _____ 82

Desert Poppies: connecting ladies in central Australia
Camilla Osborn _____ 83

SESSION 7: Adaptation and resilience

84

SPOKEN PAPERS

Adaptation as a trigger for transformation pathways in remote Indigenous communities
Yiheyis Maru et al. _____ 84

Climate change perceptions and adaptive strategies: reflections from two remote Aboriginal communities
Matthew Campbell et al. _____ 85

(Student). A predictive model of Indigenous Ranger Groups' capacity for the adaptation of heritage sites to the impacts of climate change
Bethune Carmichael _____ 86

Climate adaptation decisions by local governments
Supriya Mathew et al. _____ 87

Semi-continental scale rangeland conservation developing an agenda
Rolf Gerritsen _____ 88

Innovative transport options for enhancing liveability in Australia's rangelands
Bruno Spandonide _____ 89

POSTER

No room for wild dogs, white ants or elephants: the imperative of leading practice as multi-dimensional adaptation strategy in Australian rangeland business and public policy
Glenn Ronan et al. _____ 90

SESSION 8 Mining and energy

91

SPOKEN PAPERS

Keynote: Energy extraction and environmental outcomes
Dan Metcalfe _____ 91

(Student). How do mining towns contribute community value?: Roxby Downs and Leigh Creek
Stuart Robertson _____ 92

Mining partnerships - we can dig it!
Linda Anderson _____ 93

Using water from mine dewatering for irrigating crops in the Pilbara and the implications for the wider community in the Western Australian rangelands
Sim Mathwin _____ 94

Stacks of fire – proving the theory
Kate Masters _____ 95

SESSION 9 Natural resource management

96

SPOKEN PAPERS

Martu Living Deserts Project – partnering for conservation led by Indigenous people
Tony Jupp et al. _____ 96

(Student). New cross cultural monitoring for effective management of indigenous lands: a case study from western Arnhem land
Jeremy Freeman _____ 97

Identification of refugia in western NSW
Tony Gill et al. _____ 98

Manta Palyakutu: Ngurra kantilya kanyini! Land use and management led by Anangu on Anangu land near Indulkana, APY Lands of South Australia
Willy Wara Edwards & Walter Tjami _____ 99

MTP Contracting: Running a remote NRM business on the Barkly Tablelands
Joy and Maxie Priest _____ 100



**Australian Rangeland Society
18th Biennial Conference**
Alice Springs Northern Territory
12 - 16 April 2015
www.arsconference.com.au

TABLE OF CONTENTS

Challenging the concept of Aboriginal mosaic fire practices in the Lake Eyre Basin, with particular focus on the Cooper Creek country and adjoining Simpson Desert, 1845-2015 Dick Kimber & Marg Friedel _____	101	Habitat distribution modeling of <i>Halocnemum strobilaceum</i> and <i>Artemisia sieberi</i> species using Maximum Entropy Method (Maxent) in QUM Province rangelands Hossein piry sahragard _____	112
Understanding climate science supports adaptation in indigenous rangeland management Fiona Walsh et al. _____	102	Developing biophysical and socio-economic indicators of rangeland health John Ludwig et al. _____	113
The use of camera traps to investigate wildlife usage of remote waterholes in central Australia Jayne Brim Box et al. _____	103	A novel community approach which incorporates improving landscape function to naturally combat <i>Acacia farnesiana</i> encroachment. We are giving it a go! Marla Oodnadatta Natural Resources Management Group _____	114
The Australian Feral Camel Management Project – a model for managing the impacts of large feral herbivores at the landscape scale Glenn Edwards et al. _____	104	(Student). Grazing for biodiversity conservation and landscape function in NSW semi-arid rangelands Sarah McDonald et al. _____	115
POSTERS		Land management on the Anangu Pitjantjatjara Yankunytjatjara Lands Clint Taylor et al. _____	116
Is more or less fire needed in northern savannas? Fire history (and optimal management) varies with land use and land type Robyn Cowley & Dale Jenner _____	105	Teaching the Word – “Waterponding” and “Waterspreading” – Aus Aid style: Ray Thompson & Prasanthi Sooriyakumar _____	117
Traditional hunting of feral cats to help protect key threatened species at Kiwirrkurra Kate Crossing et al. _____	106	A collaborative approach to building community capacity and raising landscape function awareness across the rangelands Janet Walton & Camilla Osborn _____	118
Land of extremes: optimising a rearing and release strategy in response to climate and distance for a parkinsonia biological control agent in the Northern Territory Louis Elliott et al. _____	107	The interactive effects of burn intensity and mast-seeding on post-fire regeneration of slender mulga <i>Acacia aptaneura</i> Boyd Wright & Alain Zuur _____	119
Validating satellite imagery products of woody thickening using aerial photograph interpretation: methods and preliminary results Rebecca Gibson et al. _____	108	<div> SESSION 10 Policy directions 120 </div>	
Ngadju fire and conservation land management David Graham _____	109		
NRM planning for climate change in the rangelands Mary-Anne Healy & Andrew Burrow _____	110	SPOKEN PAPER	
The Territory Conservation Agreements program: promoting integrated conservation management Jon Hodgetts _____	111	Keynote: Radicalising the rangelands: disruptive change or progressive policy? Bruce Walker _____	
		120	

COMMITTEE MEMBERS

Australian Rangeland Society 18th Biennial Conference

Organising Committee Members

Mr Pieter Conradie (Chairperson)	NT Department of Primary Industry & Fisheries
Ms Michelle Armistead	CSIRO
Mr Gary Bastin	
Mr David Campbell	
Dr Margaret Friedel	Honorary Fellow, CSIRO (Chair, Program sub-committee)
Ms Sally Leigo	NT Department of Primary Industry & Fisheries
Dr Bill Low	Low Ecological Services
Ms Camilla Osborn	Centralian Land Management Association
Dr John Taylor	President and Director, Australian Rangeland Society
Mr Chris Watson	
Mr Ray Bird	(Co-ordinator) Meeting Masters

Program Sub-committee Members

Ms Sally Leigo	NT Department of Primary Industry & Fisheries
Dr Steve Morton	Honorary Fellow, CSIRO
Dr Diane Pearson	Territory Natural Resource Management
Ms Michelle Rodrigo	NT Department of Land Resource Management
Dr Dionne Walsh	NT Department of Primary Industry & Fisheries

The contributions of Ms Coral Allan, Mr Jimmy Cocking, Ms Ros Consoli, Mr Angus Duguid, Mr Jock Duncan, Mr Ben Forsyth, Ms Heidi Groffen and Ms Ilse Pickerd to the development of the Conference are appreciated.

ACKNOWLEDGEMENTS

The Council of the Australian Rangeland Society and the Organising Committee for the 18th 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 Alice Springs Town Council for hosting the Reception and welcoming delegates to Alice Springs.
- ~ Mrs Pat Miller for providing the Welcome to Country and Opening Address.

CITATION OF PAPERS

It is recommended that papers in the conference proceedings be cited in the following manner:

Bastin, G., Sparrow, A., Scarth, P., Gill, T., Barnetson, J. and Staben, G. (2015). Are we there yet? Tracking state and change in Australia's rangelands. In Proceedings of the 18th Biennial Conference of the Australian Rangeland Society, Alice Springs (Ed M.H. Friedel). (Australian Rangeland Society: Perth)



**Australian Rangeland Society
18th Biennial Conference**
Alice Springs Northern Territory
12 - 16 April 2015
www.arsconference.com.au

PROGRAM

Sunday 12 April 2015

- 8.00am **Registration desk open**
Convention Centre - Foyer
- 6.00pm **Civic Reception**
Alice Springs Civic Centre
- SPONSOR:
Alice Springs Town Council
- Official Welcome: **Mayor Damien Ryan**
Drinks and hors d'oeuvres
- 7.30 Function ends
Evening Free (enjoy Alice Springs venues)

Monday 13 April 2015

- 7.00am **Registration desk open**
Convention Centre - Foyer
- Pre-Conference Field Trips**
- 7.30 Field trips A, B and C depart
- 8.00 Field trip D departs
- 12.30pm Field trip D returns
- 4.00 Field trips A, B and C return
- 6.30 **Alice Springs Desert Park BBQ**
- SPONSORS:
**NT Dept of Primary Industry
and Fisheries, NT Dept of Land
Resource Management**
- 9.00 Last buses leave

Tuesday 14 April 2015

- 7.30 **Registration desk open**
Convention Centre - Foyer
- 8.30 **Conference opening**
Convention Centre - Ellery Room A&B
Welcome to Conference:
Mr Pieter Conradie
- 8.35 Welcome to Country:
Mrs Patricia Miller AO, Deputy of the
Administrator of the Northern Territory
- 8.40 Official opening:
Mrs Patricia Miller AO, Deputy of the
Administrator of the Northern Territory

- 8.55 Introductory remarks:
The Hon. Willem Westra van Holthe MLA

SESSION 1

- Chair: **Mr Pieter Conradie**
- 9.00 Plenary address:
The Hon. Fred Chaney AO
- 10.00 MORNING TEA

SESSION 2

Leadership and relationships

- Chair: **The Hon. Clare Martin**
SPONSOR: **Ninti One**
- 10.30 What's in a name? Making Australians
care about the Outback.
Dr Barry Traill (keynote)
- 11.00 Options for innovation in investment
models for rangelands.
Kate Forrest & Andrew Drysdale
- 11.15 Working together to improve knowledge
and understanding of climate change in
the Australian rangelands.
Mary-Anne Healy et al.
- 11.30 Innovation systems for food security in
rangeland margins, sub-Saharan Africa.
Jocelyn Davies et al.
- 11.45 A multi-disciplinary approach to research
for the development of northern Australia.
Ian Watson et al.
- 12.00 Developing an appropriate
telecommunications strategy for remote
Australia.
Apolline Kohen & Daniel Featherstone
- 12.15 Preparation of a research plan for natural
resource management in northern
Australia.
Gabriel Crowley et al.
- 12.30 LUNCH

SESSION 3 Pastoral management

- Chair: **Dr Robyn Cowley**
SPONSOR: **Meat & Livestock Australia**
- 1.30 An overview of rangeland pastoralism: has much changed and if not, what needs to change? **Dr Phil Holmes (keynote)**
- 2.00 Adaptive capacity on the rangelands. **Nadine Marshall & Matthew Curnock**
- 2.15 Stocking rate strategies that adapt the extensive beef industry in northern Australia to high inter - annual rainfall variability. **Lester Pahl et al.**
- 2.30 Ahead of the pack: what 30 years of commercial pastoral innovation can teach us. **Dionne Walsh**
- 2.45 Adding a new string to the bow of Indigenous pastoral businesses. **Jane Tincknell & Jo-Anne Craig**
- 3.00 Collaborative Area Management in south west Queensland. **Catherine Crowden**
- 3.15 Understanding wild dog predation dynamics in an Australian arid zone pastoral region. **Steve Eldridge et al.**
- 3.30 AFTERNOON TEA
- 4.00 'Rangeland Self Shepherding' - a new approach to influence grazing distribution to benefit livestock, landscapes and people. **Dean Revell et al.**
- 4.15 From concept to reality - developing new technology in remote Australia. **Sally Leigo et al.**
- 4.30 Co-presentation based on papers addressing innovative uses of remote sensing for monitoring. **Gary Bastin et al. & Michael Digby et al.**
- 5.00 **Poster viewing**
Concurrent sessions of guided poster presentations, 5-6 pm.
SPONSOR: **Meat & Livestock Australia**
- 6.00 Session ends
Evening Free (enjoy Alice Springs venues)

Wednesday 15 April 2015

- 8.00 **Registration desk open**
Convention Centre - Foyer
Convention Centre - Ellery Room A&B
- 8.30 Housekeeping

SESSION 4 Water sharing

- Chair: **Dr Ron Hacker**,
Chair of Publications Committee
SPONSOR:
Goyder Institute for Water Research
- 8.35 Introduction to the Rangeland Journal Lecture. **Prof. John Milne**
- 8.45 Rangeland Journal Lecture. **Prof. Stuart Bunn**
- 9.45 Managing the cumulative impacts from CSG water extraction in the Surat Basin, Queensland. **Randall Cox et al.**
- 10.00 Understanding environmental condition for the strategic adaptive management of Lake Eyre Basin waterways. **Dale McNeil & David Schmarr**
- 10.15 Non, je ne regrette rien: what do four years of LEBRA monitoring tell us? **David Schmarr et al.**
- 10.30 MORNING TEA
- 11.00 One River - Many Journeys: fish and drought refuges in the Finke. **Angus Duguid et al.**
- 11.15 Reading the signs: Arabana, water and country **Melissa Nursey-Bray**
- 11.30 Degraded or just dusty? Examining 150 years of ecological change in inland eastern Australia. **Jen Silcock (student) & Rod Fensham**
- 11.45 **Poster viewing**
Concurrent sessions of guided poster presentations, 11.45 am-12.30 pm.
- 12.30 LUNCH



**Australian Rangeland Society
18th Biennial Conference**
Alice Springs Northern Territory
12 - 16 April 2015
www.arsconference.com.au

PROGRAM

Concurrent session A

Convention Centre - Ellery Room A&B

SESSION 5

Stories from the rangelands

- 1.30 Interviews: **Dr Marg Friedel**
Josie Douglas
Indigenous Research Fellow
- 2.00 **Steve and Bec Cadzow**
Pastoralists, Mt Riddock Station
- 2.30 **Kaye Kessing**
Author, Illustrator and Environmentalist.
- 3.00 **Poster viewing**
Concurrent sessions of guided
poster presentations, 3-3.30 pm
- 3.30 AFTERNOON TEA

Concurrent session B

Convention Centre - Ellery Room C

SESSION 7

Adaptation and resilience

- Chair: **Dr Dana Kelly**
- 1.30 Adaptation as a trigger for transformation
pathways in remote Indigenous
communities. **Yiheyis Maru et al.**
- 1.45 Climate change perceptions and adaptive
strategies: reflections from two remote
Aboriginal communities.
Matthew Campbell et al.
- 2.00 A preliminary framework for Indigenous
heritage climate adaptation.
Bethune Carmichael (student)
- 2.15 Climate adaptation decisions by local
governments. **Supriya Mathew**
- 2.30 Semi-continental scale rangeland
conservation: a developing agenda.
Rolf Gerritson
- 2.45 Innovative transport options for enhancing
liveability in Australia's rangelands.
Bruno Spandonide
- 3.00 **Poster viewing**
Concurrent sessions of guided
poster presentations, 3-3.30 pm
- 3.30 AFTERNOON TEA

Concurrent session A

Convention Centre - Ellery Room A&B

SESSION 6

Communication

- Chair: **Michelle Rodrigo**
- 4.00 Aboriginal people choose new media for
an old practice. **Fiona Walsh et al.**
- 4.15 Western Arrarnta seasonal chart
Else Kennedy et al.
- 4.30 Building on the knowledge of the
Aboriginal land managers of tomorrow.
Meg Mooney
- 4.45 Using eExtension to enable change in the
rangelands. **John James**
- 5.00 Australian Outback: Heart of a Continent -
developing a documentary. **Alun Hoggett**
- 5.30 Session ends
Evening Free (enjoy Alice Springs venues)

Concurrent session B

Convention Centre - Ellery Room C

SESSION 8

Mining and energy

- Chair: **Dr Jocelyn Davies**
- SPONSOR: **Santos Limited**
- 4.00 Energy extraction and environmental
outcomes. **Dr Dan Metcalfe (keynote)**
- 4.30 How do mining towns contribute
community value? Roxby Downs and
Leigh Creek. **Stuart Robertson (student)**
- 4.45 Mining partnerships - we can dig it!
Linda Anderson
- 5.00 Using water from mine dewatering for
irrigating crops in the Pilbara and the
implications for the wider community in
the Western Australian rangelands.
Sim Mathwin
- 5.15 Stacks of fire - proving the theory.
Kate Masters
- 5.30 Session ends
Evening Free (enjoy Alice Springs venues)

Innovation in

Thursday 16 April 2015

- 7.30 **Registration desk opens**
Convention Centre - Foyer
- 8.00 Convention Centre - Ellery Room A&B
Australian Rangeland Society
General Meeting
Chair: **Dr John Taylor**
President Australian Rangeland Society
- 9.40 Housekeeping

SESSION 9

Natural resource management

- Chair: **Dr Ian Watson**
SPONSOR: **The Pew Charitable Trusts**
- 9.45 Martu Living Deserts Project –partnering for conservation led by Indigenous people. **Tony Jupp et al.**
- 10.00 New cross cultural monitoring for effective management of indigenous lands: a case study from Western Arnhem Land.
Jeremy Freeman (student) & senior (Arnhem) land manager
- 10.15 Identification of refugia in western NSW
Tony Gill et al.
- 10.30 MORNING TEA
- 11.00 Manta Palyakutu: Ngurra kantilya kanyini! Land use and management led by Anangu on Anangu land near Indulkana, APY Lands of South Australia.
Willy Wara Edwards & Walter Tjami
- 11.15 MTP Contracting: Running a remote NRM business on the Barkly Tablelands.
Joy and Maxie Priest
- 11.30 Challenging the concept of Aboriginal mosaic fire practices in the Lake Eyre Basin, with particular focus on the Cooper Creek country and adjoining Simpson Desert, 1845-2015.
Dick Kimber and Marg Friedel
- 11.45 Understanding climate science supports adaptation in indigenous rangeland management. **Fiona Walsh et al.**

- 12.00pm The use of camera traps to investigate wildlife usage of remote waterholes in central Australia. **Jayne Brim Box et al.**
- 12.15 The Australian Feral Camel Management Project: a model for managing the impacts of large feral herbivores at the landscape scale. **Donna Digby et al.**
- 12.30 LUNCH

SESSION 10

Policy directions

- Chair: **Dr Steve Morton**
- 1.30 Radicalising the rangelands: disruptive change or progressive policy?
Dr Bruce Walker (keynote)
- 2.00 Panel discussion: Panel members include **The Hon. Clare Martin, The Hon. Fred Chaney and Dr Steve Rogers**
- 3.00 AFTERNOON TEA

SESSION 11

Conference Summation and Close

- Chair: **Mr Pieter Conradie**
- 3.30 Summation - conference main themes, outcomes and recommendations.
Dr Andrew Ash & Ms Kate Forrest
- 3.45 Acknowledgements
Mr Pieter Conradie
- 4.00 Close
- 6.15 **Gala Conference Dinner**
Old Quarry
Australian Rangeland Society
40th anniversary celebrations
Master of Ceremonies: **Dr John Taylor**
Sponsor: **The Rangeland NRM Alliance and the Australian Rangeland Society**
- 10.30 Dinner ends. Last buses leave 11.00pm



**Australian Rangeland Society
18th Biennial Conference**

Alice Springs Northern Territory
12 - 16 April 2015

www.arsconference.com.au

Abstracts for the 18th Australian Rangeland Society Conference: “Innovation in the Rangelands”

SESSION 2
Leadership and relationships

SPOKEN PAPER

Keynote: What’s in a name? Making Australians care about the Outback

Barry Traill

Director, Outback to Oceans Program, Pew Charitable Trusts.
E: btraill@pewtrusts.org,
www.pewenvironment.org/outbackaustralia

Outback landscapes, also known as the rangelands, or simply remote Australia, cover around 70% of Australia. This includes the savannas of Northern Australia and the semi-arid and arid zones. Recent global analyses show that the Outback is one of the few vast natural landscapes remaining on Earth. For some, the Outback is not seen as a singular whole, as its ecosystems are diverse, ranging from deserts to rainforests. Viewing it as an integrated whole, however, is vital for its future.

A range of ecological processes operate at vast scales, linking parts of the Outback. Most importantly, the geo-politics are alike across its different parts. Communities and individual landholders have similar land tenures, resource industries, social issues and environmental threats, in districts as diverse as the Great Western Woodlands and Cape York Peninsula.

From a nature conservation viewpoint, it is fundamental to maintain and reinstate active land management across Outback landscapes, many of which are now empty, or largely empty, of people. There are existing successful programs and approaches for Outback lands which can be improved and expanded to deliver social and economic development while supporting ecological integrity. Examples are the highly successful Indigenous land management programs, and the diversification into new enterprises on pastoral leasehold lands that are no longer commercially viable for grazing.

The long term success of such approaches requires a much heartier and longer-term engagement by the Australian public and decision-makers than currently exists. More than 96% of Australians live in locales distant from the Outback and most are largely ignorant of the issues of remote Australia. Simply putting forward solutions to little known problems of remote Australia will fail to deliver major outcomes. In order to establish long-term support for improvements and solutions, broad engagement of the Australian public with their Outback is required.

Investigating options for innovation in investment and policy models for rangelands

Kate Forrest^A and Andrew Drysdale^B

^ADesert Channels Queensland,
92 Galah St, Longreach, QLD 4730
E: kate.forrest@dcq.org.au

^BQld NRM Groups Collective,
PO Box 4608 Toowoomba East QLD 4350

KEYWORDS: collaboration, innovation, investment, national, rangelands, NRM

The National Rangeland NRM Alliance (The Alliance) is a collaboration of 14 rangelands natural resource management bodies operating across 81 per cent of Australia's landmass. The group works together and with partners to gain traction where individually they have little. It can seem confusing to have Cape York and Western NSW in one group but the members have found that the basic issues for NRM are the same, however, stressing that it is vital on-ground delivery is adjusted for local environments.

The Alliance has been particularly active over the past 5 years in responding, and providing input, to Government policy and programs for natural resource management. The aim is to have the rangelands recognised as a significantly different operating environment and deserving of alternative policy and funding approaches.

The Alliance has begun a process of investigating alternative investment models to overcome some of the pitfalls of short term funding in an environment where change occurs over large areas in long time frames often interrupted by large climatic variability. It is these options which the Alliance wishes to introduce and discuss with the ARS Conference audience in April 2015.

Working together to improve knowledge and understanding of climate change in the Australian rangelands

Mary-Anne Healy^A, Kate Forrest^B and Gary Bastin^C

^ANinti One,
PO Box 3971 Alice Springs NT 0871.
E: Maryanne.healy@nintione.com.au, Ph: 0438890947

^BRangeland NRM Alliance, Adelaide.
E: kate.forrest@dcq.org.au, Ph: 0499 367 077

^CFormerly CSIRO Land & Water, Alice Springs.
E: gary-bastin@bigpond.com

KEYWORDS: climate change, NRM planning, collaboration, research, knowledge broker, adaptation

The Rangelands Cluster Project is working to facilitate climate change science into natural resource management planning across some of the driest and hottest country on earth. The project has created new pathways for existing information which allowed researchers to take existing data and analyse/present it in new ways to provide relevant and current information for planning for climate change.

Planning for climate change adaptation in the rangelands encompasses many challenges including:

- small (and declining) populations,
- poor institutional and governance capacity, struggling to implement delivery models based on closer settled coastal communities,
- low socio-economic communities,
- large distances ,
- different seasonal cycles (ie not 4 seasons), and
- production systems which rely on managing naturally occurring systems for production outcomes.

Residents within the rangelands consider themselves capable in dealing with climate variability in current systems but many questions remain on the future activities across the region. Adding the predicted rise in temperatures and uncertainty regarding rainfall, means these already vulnerable communities will face even greater challenges. But people are resourceful and resilient. They are looking for information, relevant tools and guidance to enable better planning for adaptation.

This collaboration between the Rangelands NRM Alliance, CSIRO, University of Canberra and Ninti One has taken an innovative approach for a project of this type by using an independent knowledge broker to facilitate researchers and NRM Planners to work together to develop targeted products.

Innovation systems for food security in rangeland margins, sub-Saharan Africa

Jocelyn Davies^A, Ian Watson^B, Andrew Hall^C, Fafa Sow^D, Souleymane Ouedraogo^E and Kumuda Dorai^F

^ACSIRO, Desert Knowledge Precinct, Alice Springs, NT 0871, Australia.
E: jocelyn.davies@csiro.au, Ph: 08 8950 7152

^BCSIRO, PMB Aitkenvale, QLD 4810, Australia. E: ian.watson@csiro.au, Ph: 07 4753 8606

^CCSIRO, GPO Box 1700, ACT 2601, Australia. E: andrew.hall@csiro.au, Ph: 0424 156 105

^DISRA, CRZ Dahra ISRA, PB.01, Senegal. E: sowvet2002@yahoo.fr, Ph: +221 77 619 10 92

^EINERA, Station de Farako-Bâ, 01 BP 910, Bobo-Dioulasso 01, Burkina Faso.
E: soul_oueder@hotmail.com, Ph: +226 70 26 47 19

^FLINK Ltd., Canberra, Australia. E: kumuda.dorai@gmail.com

KEYWORDS: Innovation Platform, institutional change, multi-stakeholder, collaboration, milk

Failure of traditional research and technology delivery arrangements to make a substantial difference to food security in sub-Saharan Africa has led to approaches that take a systems view of innovation. Innovation emerges, not just from research, but through a continuous process of sharing, combining and making use of ideas and information that come from many different actors. Interaction between these actors promotes this information sharing and use. Innovation is understood not just as technical change, but can also include changes in modes and organisation of production, marketing, research practice and policy settings. A key insight from this perspective is the patterns and effectiveness of these interactions are greatly influenced by the culture, norms, routines and policies – institutional arrangements – that shape the practices of different actors including researchers. In recent years in sub-Saharan Africa a mechanism to build the relationships and institutional setting that promote interactive innovation has taken operational form as ‘innovation platforms’ (IPs). These usually take the form of local-level multi-stakeholder groups with an agenda of enabling innovation that strengthens production and associated value chains. These are sometimes nested with similar fora at regional or national scales for policy change and broader market influence.

Our case study, from the village of Thiel in the semi-arid Linguere region of Senegal, used an IP to promote innovation in an extensive livestock production system. We report on changes in production, markets, research and extension services and associated practices and institutions that were observed since the IP was formed. We discuss factors that actors involved in the Thiel IP consider have been important for fostering and sustaining these changes. We explore the extent to which changes in livestock owners’ livelihoods can be attributed to a system engagement with the innovation process and consider prospects for sustaining and extending such impacts, particularly in rangelands.

A multi-disciplinary approach to research for the development of northern Australia

Ian Watson^A, Cuan Petheram^B and Peter Stone^C

^ACSIRO,
PMB Aitkenvale, QLD 4810.
E: ian.watson@csiro.au, Ph: 07 4753 8606

^BCSIRO,
GPO Box 1666, Canberra, ACT 2601. E:
cuan.petheram@csiro.au, Ph: 02 6246 5987

^CCSIRO,
41 Boggo Road, Dutton Park, QLD 4102.
E: peter.stone@csiro.au, Ph: 07 3833 5659

KEYWORDS: agricultural development; inter-disciplinary; northern development; land suitability; water resources; organizational learning

Research to underpin the green-field development of northern Australia requires the integration of science from a wide range of disciplines. Data and information on natural resources for most areas of northern Australia is at insufficient resolution to support green-field agricultural development. Socio-economic information is similarly depauperate, particularly at the scales with which development is likely to occur and in relation to the specific types of development that might be locally possible. The combination of the biophysical, social, cultural and institutional environments in northern Australia is different to that found elsewhere and requires that research considers these factors in a coherent way.

We report on one such body of research that examined the scale of opportunity for agricultural development in the Flinders and Gilbert catchments in the Gulf region of north Queensland, the Flinders and Gilbert Agricultural Resource Assessment (FGARA). The assessment included input from a very broad range of scientific disciplines including those concerned with soil property and land suitability mapping, climate variability, climate change, surface hydrology, groundwater systems, flood frequency and extent, geophysics, agricultural productivity, water storage and transmission, irrigation, Indigenous water values and aspirations, social impacts, local and regional scale economics and aquatic ecology. The assessment was truly multi-disciplinary in its approach, and included scientific input from over 100 people. The advantages to this multi-disciplinary approach are many but it does increase the transaction costs. Similarly, there are advantages to taking a more inter-disciplinary approach in some circumstances. For projects of this scale, size and timeline a mixed approach is appropriate – balancing the need to minimise transaction costs and make the most efficient use of resources with the need to provide a well integrated and coherent synthesis to stakeholders.

Developing an appropriate telecommunications strategy for remote Australia

On behalf of the Broadband for the Bush Alliance:
Apolline Kohen^A and Daniel Featherstone^B

^ANinti One Limited,
PO Box 3971 Alice Springs NT 0871.
E: apolline.kohen@nintione.com.au, M: 0400 688 386

^BIRCA, PO Box 2731,
Alice Springs NT 0871.
E: manager@irca.net.au, M: 0437 798 076

KEYWORDS: telecommunications, digital infrastructure, digital economy, digital inclusion, remote Australia digital aspirations and needs

Access to reliable digital communication technology is the norm for most Australians. The exponential growth of smartphone use continues to revolutionise the way in which Australians conduct their personal and professional lives. Remote Australia, however, has not been able to fully engage and participate in the digital revolution because of a lack of adequate infrastructure, affordability issues and, for most, poor digital literacy. Unlocking the digital potential of the bush has the potential to ignite economic growth in remote areas, including Aboriginal and Torres Strait Islander communities. There is a need for government to better understand remote regions' digital aspirations and priorities.

The Broadband for the Bush Alliance (the Alliance) brings together organisations that seek to advance the digital capacity and capability of remote Australians. The Alliance believes that without a targeted, well-resourced, evidence-based strategy, remote Australians will be left to play 'catch up' with the rest of the world. The Alliance has developed a number of policy papers that can assist in the development of an appropriate telecommunications strategy. This paper presents how such a strategy should be developed and what it should encompass. It considers:

- 1 the expansion of mobile coverage;
- 2 getting digital infrastructure right;
- 3 smart 'last mile' solutions for small towns and communities;
- 4 affordable pricing for mobile calls in remote and rural Australia;
- 5 improved digital literacy; and
- 6 improving Indigenous ICT education programs.

Preparation of a research plan for natural resource management in northern Australia

Gabriel Crowley^A, Allan Dale^A
and representatives of northern Natural Resource Management groups
and Regional Development Australia boards

^AThe Cairn Institute, James Cook University,
PO Box 6811 Cairns Qld 4870.
E: gabriel.crowley@jcu.edu.au

KEYWORDS: co-research, environmental management, research delivery, uptake and adoption

Revision of the federal government's environmental research priorities provided an opportunity to define research priorities for on-ground delivery of Natural Resource Management (NRM) in northern Australia. To this end, 11 NRM groups and seven Regional Development Australia (RDA) boards collaborated to develop a plan identifying their research priorities and preferred delivery model. These groups participated at all stages of plan drafting, revision and finalisation through conversations guided by a semi-structured response framework; a workshop; and circulation of plan drafts.

Forty-eight potential projects were identified addressing 39 priority research needs in five research themes

- 1 Governance, policy and influence
- 2 Sustainable livelihood and agricultural options
- 3 Water resource planning and water quality improvement
- 4 Landscape planning for land use and management
- 5 Biodiversity and wetlands management

NRM groups and RDAs consider themselves core partners in environmental research programs from bid development to project delivery. Action research is therefore their preferred model. As key stakeholders they can also enhance research performance through

- Direct investment in research and brokering partnerships with other investors
- Insight about knowledge needs and program operation
- Access to extensive networks to ensure two-way communication between researchers and stakeholders and maximise research uptake
- Access to research locations, partners and case studies

Strategically-managed processes and partnership arrangements are required to formalise these roles, responsibilities and expectations. In particular, adequate time and resources should be allocated to enable active engagement and participation.

National Environment Research Program (NERP) Tropical Ecosystems Hub funded this project, with support from NERP Northern Australia.

The Cooperative Research Centre for Remote Economic Participation: A mid-term update

Steve Blake and Kevin Williams

Co-Research Managers – CRC-REP, Ninti One.

E: Steve.Blake@nintione.com.au, Kevin.Williams@nintione.com.au, M: 0409 183 277

KEYWORDS: remote, economic, CRC, policy, impact, rangelands

The Cooperative Research Centre for Remote Economic Participation (CRC-REP) was established in 2010. CRC-REP, managed by Ninti One, aims to provide practical responses to the complex issues that drive remote economic participation in Australia with a special emphasis on Aboriginal and Torres Strait Islander communities which comprise a large part of the “Remote” Australia Rangelands landscape.

The CRC-REP research agenda has been established around three research programs: Regional Economies and strengthening the economies of remote regions; Enterprise Development and building remote enterprises to provide jobs and livelihoods for people living in remote regions; and Investing in People through improving the education and training pathways for people living in remote regions, as well as a consideration of general health and wellbeing.

This paper presents a summary of the twelve projects that make up the three research programs, as well as the preliminary findings emerging, noting most projects are approximately half way through their term. We discuss the outputs, usages and impacts of the CRC-REP research to-date and some preliminary implications for policy and management in the Rangelands. Whilst the policy environment constantly changes for those living in Rangelands, the benefits and outputs of these longer-term research projects we believe, will stand the test of time and should provide for a better evidence-base for more targeted decision-making.

Keynote: Rangeland pastoralism: change and sustainability

P R Holmes

Holmes & Co, PO Box 312,
Gordon NSW 2072.
E: prholmes@bigpond.net.au, M: 0427 100 649

The major challenges faced by rangeland pastoralism for survival have not changed significantly for a long time. Whilst they may appear in a different guise, fundamentally the same challenges prevail. Paradoxically, despite a great deal of research and extension, the capacity and ability of the majority of rangeland pastoralists to meet those challenges has not changed significantly either. It is fair to say that there is now a greater awareness of the need to maintain environmental stability in those rangelands used for pastoralism and it can be argued that the addition of this objective to the challenges has complicated the overall picture. However, it has not made impossible the overcoming of the challenges.

As has always been the case, the major challenge lies inside the head of the pastoralist. Today, that pastoralist has more opportunity to gain the necessary knowledge in finance, production, genetics, marketing and environmental management than ever before. At least 40 years of valuable research is available for immediate use. Much of this research has never been properly extended. In fact, the models used for rangeland extension over the last 40 years have largely failed.

The most serious challenges facing rangeland pastoralism are relatively easy to identify. Concurrently, a pastoralist must be able to demonstrate long-term environmental and economic sustainability, and the available evidence would suggest that the two objectives are antagonistic much of the time. Nevertheless, it is possible for almost any pastoralist with the right mindset to achieve these objectives. The minimal requirements for this are financial literacy and a business approach, a deep understanding of the fundamental biology of beef cattle and/or sheep and their key profit drivers, and an uncompromising attitude to the preservation of the rangeland environment.

Adaptive capacity on the rangelands:

Nadine A. Marshall and Matthew Curnock

CSIRO Land and Water,
ATSIP Building, #145, James Cook University, Townsville Q 4811.
E: nadine.marshall@csiro.au, matt.curnock@csiro.au, Ph: 07 4750 8500

KEYWORDS: social science, resilience, adoption of new practices, climate adaptation, vulnerability to change, resource dependency

We present an overview of a range of social science projects that have recently been conducted on the northern Australian rangelands. These projects have focused on understanding the current capacity of beef producers to adopt new strategies so as to better adapt to the impacts of climate change. We assess the capacity to adapt as comprising four essential elements: i) managing risk and uncertainty, ii) possessing strategic skill sets such as planning, experimenting, refining and learning, iii) psychological and financial buffers, and iv) an interest in change. These elements represent the ability to convert current resources into a successful adaptation strategy and trajectory. Our results show that there is an apparent lack of suitable capacity currently existing within the industry to meet the challenges of the future. For example, our results found that only 16% of producers are likely to have sufficient adaptive or transformational capacity. Results also highlight several factors that are associated with producers that are more successful through time. For example, we have learned that producers with strong networks and levels of trust with informal and formal connections, a strong locus of control, larger properties, a focus on profitability, and use technology, are more likely to remain within the industry through time. These factors could be used as a basis for enhancing adaptive capacity. We suggest that an efficient strategy for ensuring viability on the Australian rangelands would be to invest in developing the capacity of producers to better cope and adapt to change.

Extensive beef stocking rate strategies for coping with rainfall variability

Lester I. Pahl^A, Joe C. Scanlan^A, Giselle L. Whish^A, Robyn A. Cowley^B and Neil D. MacLeod^C

^AQueensland Dept. of Agriculture, Fisheries and Forestry,
Toowoomba, Qld. 4350.

E: lester.pahl@daff.qld.gov.au, Ph: 07 4688 1302,

E: joe.scanlan@daff.qld.gov.au, Ph: 07 4688 1243,

E: giselle.whish@daff.qld.gov.au, Ph: 07 4688 1242

^BNorthern Territory Dept. of Primary Industry and Fisheries,
Katherine, NT, 0851.

E: Robyn.Cowley@nt.gov.au, Ph: 07 3201 2693

^CCSIRO Ecosystem Sciences, EcoSciences Precinct,
Brisbane, Qld.4102.

E: neil.macleod@csiro.au, Ph: 07 3833 5729

KEYWORDS: stocking rate management, rainfall, pasture condition, cattle productivity

This simulation study compared the cattle productivity and sustainability of fixed stocking with that of 55 flexible stocking strategies at 28 locations across Queensland and the Northern Territory which differed in rainfall amount and variability. Flexible stocking strategies differed markedly in the extent they could increase or decrease stocking rates in response to the amount of forage available at the end of each pasture growing season.

Relative to fixed stocking at the mesic locations (>700mm mean annual rainfall), flexible stocking caused a small decline in pasture condition while offering only a small gain in LWG/ha, and thus does not perform better than fixed stocking. At all other arid and semi-arid locations, cattle productivity was maximised by strategies which increased and decreased stocking rates markedly after good and poor growing seasons respectively. This was particularly evident at the most arid locations, where these strategies achieved LWG/ha double to triple that of fixed stocking. However, this was not sustainable. In comparison, flexible strategies with 20 or 30% limits for annual increases and an 80% limit for annual decreases in stocking rate achieved 10-70% higher LWG/ha than fixed stocking with only a small decline in pasture condition. While these highly flexible strategies perform well, they are unlikely to be practical. More practical is constrained flexibility with a 10% annual increase and 20% annual decrease in stocking rate. At the majority of locations, this strategy achieved 5-25% higher LWG/ha than fixed stocking whilst maintaining pasture condition.

Ahead of the pack: what 30 years of commercial pastoral innovation can teach us

Dionne Walsh

NT Department of Primary Industry & Fisheries,
GPO Box 3000, Darwin NT 0801.
E: dionne.walsh@nt.gov.au; Ph: 08 8999 2178

KEYWORDS: productivity, profitability, Barkly Tableland, cattle

This paper documents three decades of innovation by a leading producer in the Barkly region of the Northern Territory. Many of the practices are being adopted by other producers, including infrastructure development, genetic and fertility selection, cross-breeding and sustainable stocking rate management.

Since 1981, management changes on the study property have resulted in a >50% increase in carrying capacity and herd size, a 46% improvement in weaning rate, an 82% reduction in breeder mortality rate and the maintenance of good land condition. Live weight turn-off per adult equivalent (AE) has increased from 75 kg to 128 kg. Gross margin per AE has improved by almost 300%.

This paper presents two additional scenarios that apply to many northern beef businesses. The first examined how the business would be performing if it had the current herd size but still had the same herd productivity as 30 years ago (i.e. similar to current average industry performance). The second scenario examined what the business would look like if it was generating today's annual weaner crop with the herd productivity of 30 years ago.

In Scenario 1, the property would have to carry more head to generate the same AE, and mate and retain more breeders, but would still produce less weaners than it does today. The economic implications of this "industry average" productivity are higher direct costs and significant lost livestock revenue. In Scenario 2, the property would have to carry almost twice as many head (far exceeding the sustainable carrying capacity) and would still generate less livestock revenue than it does today. The findings illustrate the dangers of simply increasing herd size without regard for sustainable carrying capacity and herd productivity.

Adding a new string to the bow of Indigenous pastoral businesses

Jane Tincknell^A and Jo-Anne Craig^B

^ADepartment of Primary Industry and Fisheries,
PO Box 8760, Alice Springs, NT, 0871.
E: jane.tincknell@nt.gov.au, Ph: 08 8951 8100

^BMistake Creek, PMB 122, via Katherine NT 0852

KEYWORDS: indigenous pastoral, business management, community aspirations, financial analysis, change

Rising input costs, unstable markets, declining herd productivity and a variable climate all make a challenging environment to operate a pastoral business. In addition to these challenges, Indigenous pastoral businesses also need to manage community aspirations connected to country.

The Business Management Advisory Project (BMAP) is one of many initiatives of the Indigenous Pastoral Program (IPP) and is funded by the Indigenous Land Corporation. The goal of BMAP is to increase the professionalism and profitability of IPP stations involved in the project in order to provide positive flow-on effects for local communities and regions.

There are six pastoral businesses within the Northern Territory involved in the BMAP project. Representatives of the Indigenous pastoral industry are a part of the delivery team to ensure the project maintains relevance and delivers on-country results. Private agribusiness consultants along with staff from government agencies and land councils complete the project delivery team.

A key consideration for this project was that change would be required if these businesses are going to survive current challenges. Initially, some pastoral businesses had identified their business goals as *increased herd size* or *cash reserve*. However, after BMAP analysis of their financial data, these businesses were able to identify and prioritise new business goals to allow long term survival of their business. A common theme from this financial analysis for all businesses is to decrease overhead expenses and improve herd productivity. The challenge is now with the boards of these Indigenous pastoral businesses and their managers to create new habits that improve: firstly data collection, analysis and reporting; secondly communication between the board, manager and staff; and thirdly treat the property like a business and spend time doing strategic planning. Strong, healthy Indigenous pastoral businesses can help provide the foundation for community aspirations.

Collaborative Area Management

Catherine Crowden

South West NRM,
66 Galatea Street, Charleville, QLD 4470.
E: cam@swnrm.org.au, Ph: 07 4656 8524, M: 0409 365 446

KEYWORDS: collaboration, predation, grazing-pressure, landholders, economic, fencing

The main industry for much of south west Queensland has traditionally been wool production however a recent decline in sheep and an increase in the cattle industry is evident, due in part to an increase in wild dog numbers and heavy predation. With a strong correlation between the decline in the sheep industry and economic viability of rural communities in South West Qld, the provision of measures that develop sheep industry resilience and profitability has become a major focus of South West NRM along with other industry groups.

Collaborative Area Management (CAM) is a state government funded innovation grant which South West NRM manages. The development of CAM cluster sites aims to reduce total grazing pressure on a landscape scale. Additional beneficial outcomes include opportunities to coordinate a reduction in predation from wild dog and manage other issues such as weed infestation. The CAM projects are monitored for improved pasture condition and decrease in weed and pest species in combination with on farm stock data and improved community economic parameters.

The CAM project funds high integrity fencing for areas of a minimum 150,000ha in an attempt to limit macropod access to pasture and reduce stock loss through predation. Collaboration between landholders is the key to the success of this project by mobilising groups of landholders who are motivated for change. Proportional and in kind contributions from landholders along with subsidy from a grant form the basis of the fencing project. Economic analysis has forecast that the social and environmental payback periods for funding contributions to this project are between 2 and 5 years. Despite this, a return to the sheep industry is only possible if landholders work together not only to fence out pests but to mitigate the issues left within the clusters fenced area.

It is envisaged that the initial CAM sites will serve as an industry benchmark highlighting the significant benefits of Collaborative Area Management which in turn will attract further support from funding authorities.

Understanding wild dog predation dynamics in an Australian arid zone pastoral region

Steve Eldridge^A, Heather Miller^B, John Read^{CD}, Peter Bird^E, Greg Campbell^F, Remy Van de Ven^G and Ben Allen^H

^ADesert Wildlife Services,
PO Box 4002, Alice Springs, NT 0871. E: desertws@bigpond.net.au

^BNatural Resources SA Arid Lands,
PO Box 78, Port Augusta, SA 5700

^CEcological Horizons Pty Ltd,
PO Box 207, Kimba, SA 5064

^DUniversity of Adelaide,
North Terrace, Adelaide SA, 5000

^EPrimary Industries & Regions SA,
GPO Box 1671, Adelaide, SA 5001

^FS. Kidman & Co Ltd,
183 Archer St, North Adelaide, SA 5006

^GNSW Department of Primary Industries,
1447 Forest Rd, Orange, NSW 2800

^HDepartment of Agriculture, Fisheries & Forestry,
PO Box 102, Toowoomba, Qld 4350

Beef producers throughout Australia's rangelands commonly identify predation by wild dogs as a significant threat to calf survival. Lethal control of wild dogs is advocated as a means to reduce production losses. But as an apex predator, wild dogs play important environmental roles in some environments, including limiting numbers of herbivores that compete with cattle and limiting subordinate predator (mesopredator) populations. The effects of lethal wild dog control on prey species and mesopredators in the pastoral zone is not well understood, particularly in arid areas where the climate is highly variable and prey availability is often dependent on the "boom or bust" cycles typical of many prey species. In this study, we examined the influence of wild dog predation on the population dynamics of mesopredators and prey species in an arid zone pastoral district, focusing on the effect of sustained lethal wild dog control. We measured predator and prey activity levels in areas subjected to twice-yearly poison baiting, and paired areas without control over a 6-year period on 5 pastoral properties in northern South Australia. Concurrently, wild dog diet was examined by analysing scat samples collected from each treatment area. Preliminary results indicate a strong association between predator and prey activity and seasonal conditions across all treatment areas. Wild dog activity was consistently lower in baited areas on all properties, yet the influence of baiting on mesopredator and prey populations varied between properties. Implications for wild dog management in the pastoral zone will be discussed.

‘Rangeland Self Shepherding’ – positively influencing grazing distribution to benefit livestock, landscapes and people

D.K. Revell^{AB}, B. Maynard^C, P.A. Erkelenz^D and D. Thomas^E

^ARevell Science,
10 Wade Close, Duncraig WA 6023. E: dean@revellscience.com.au, M: 0408 904 948

^BSchool of Animal Biology, The University of Western Australia,
Nedlands WA 6009

^CStress Free Stockmanship,
Narromine NSW 2821. E: brucemaynard@bigpond.com, M: 0428 890 110

^DRangelands NRM,
Geraldton WA 6530. E: paule@rangelandswa.com.au, Ph: 08 9964 8249

^ECSIRO Agriculture Flagship,
Private Bag 5, Wembley WA 6913. E: dean.thomas@csiro.au, Ph: 08 9333 6671

KEYWORDS: landscape function, animal behaviour, grazing distribution, adaptive management, livestock

Landscape function in rangelands is affected by the behaviours of livestock and other animals, and flow-on plant-soil interactions. Conventional approaches to manage grazing have relied on physical restrictions, using means such as fencing and water exclusion. Rangeland Self Shepherding (RSS) is a new approach that uses behavioural science and practice to change existing livestock behaviours and initiate beneficial new habits. RSS draws together innovative ways to use existing tools and infrastructure to affect livestock movement, consumption and occupancy of areas. This allows managers to move animals by the animals exercising choices. The immediate payoffs for pastoral enterprises include gaining the benefits of more controlled and intensive grazing without increasing management or infrastructure intensity, improved monitoring and flexibility via shorter feedback loops, and improved production from livestock that initiate more exploratory grazing behaviours.

Over- and under-utilisation of areas has traditionally been seen as an inevitable consequence of patch grazing activity that is magnified in rangeland situations due to the larger areas. These grazing-related effects can become self-reinforcing and repeated over long periods unless changes in behaviour are actively encouraged. It is here that RSS has a pivotal role in expanding the range of vegetation and habitats used by livestock, thereby achieving a more even impact over their environment.

The underlying principles that shape diet and habitat selection include reward expectancies, feedback mechanisms that allow animals to learn the consequences of their behaviours, experiential learning over time and from other animals, and adaptations that become part of a broader array of grazing behaviours. RSS involves using a large number of individual tactics in combinations to have multiplier effects on livestock behaviours. We have shown that land managers can modify experiences of livestock to help form new behaviours to enhance productivity and natural resource management.

From concept to reality – developing new technology in remote Australia

Sally Leigo^A, David Phelps^B, Greg Brennan^C, Tim Driver^D and Ian McLean^E

^ACRC for Remote Economic Participation and Department of Primary Industry and Fisheries, Alice Springs, NT. E: Sally.Leigo@nt.gov.au

^BDepartment of Agriculture, Fisheries and Forestry, Longreach, Qld.

^CDepartment of Agriculture and Food, Geraldton, WA.

^DPrecision Pastoral Pty Ltd, Alice Springs, NT.

^EBush Agribusiness, Toowoomba, Qld

KEYWORDS: technology, decision support systems, technology development and precision agriculture

There is a need for beef businesses to regularly collect and analyse data about cattle and pasture performance, to benchmark and improve business performance, to set and adjust stocking rates, to implement supplementation programs and to plan long-term carrying capacities. High costs of mustering; weather conditions; and lack of labour, infrastructure and on-farm skills can prevent timely weighing of cattle or measurements of pasture. The Precision Pastoral Management System (PPMS) seeks to automate these tasks and deliver the results to the manager's computer. Industry consultation revealed support for the concept, and development began in 2011 by the CRC for Remote Economic Participation. To minimise adoption barriers, beef producers are engaged in development and trialling. While commercialisation of the PPMS is still some years away, the project team's experiences may assist other researchers to develop technology products for beef producers in remote Australia.

Are we there yet? Tracking state and change in Australia's rangelands

Gary Bastin^A, Ashley Sparrow^B, Peter Scarth^C, Tony Gill^D, Jason Barnetson^E and Grant Staben^F

^AFormerly CSIRO Land & Water,
PO Box 2111, Alice Springs NT 0871.
Corresponding author E: gary-bastin@bigpond.com

^BCSIRO Land & Water,
Private Bag 5, Wembley WA 6913

^CQueensland Department of Science, Information Technology, Innovation and the Arts,
GPO Box 2454, Brisbane Qld 4001

^DNSW Office of Environment and Heritage,
PO Box 1020, Dubbo NSW 2830

^ENT Department of Land Resource Management,
PO Box 1120, Alice Springs NT 0871.
Presenting author: E: Jason.Barnetson@nt.gov.au, Ph 08 8951 9259]

^FNT Department of Land Resource Management,
PO Box 496, Palmerston NT 0831

KEYWORDS: change, cover deficit, ground cover, Landsat, persistence, state

Objectively monitoring trend in the state of Australia's grazed rangelands has proven elusive because of their extensive area and considerable spatial and temporal variability. National archives of fractional vegetation cover derived from satellite data now mean that this problem is more tractable. Through the Australian Collaborative Rangelands Information System, we developed and tested a dynamic reference cover method that objectively separates grazing effects on ground cover from that due to inter-annual variation in rainfall. The method is based on the persistence of ground cover in years of lower rainfall. An indicator of rangeland state for Landsat TM pixels is produced by subtracting automatically calculated reference cover from actual ground cover and then spatially averaging these deficits across a paddock, pastoral lease or larger reporting region as required. Change in the mean cover deficit between sequences of dry years reliably indicates change due to grazing.

We have used the method to report state and change in approximately half of the Queensland rangelands between 1988 and 2005 (recent paper in *The Rangeland Journal*) and all of the NSW rangelands between 1992 and 2013 (results not yet published). In progressing towards a national capacity to track the state of Australia's grazed rangelands objectively, based on ground-cover dynamics, we will run a more contemporary and complete analysis for the Queensland rangelands and include the NT to generate results that complement those currently available for NSW. This enlarged analysis is possible with the availability of suitably calibrated and validated Landsat-derived fractional vegetation cover through the NT Government's formal association with the Joint Remote Sensing Research Program. Change in cover-deficit values between dry years at pixel to paddock resolution may also provide useful information for land managers and their advisors as web-based technologies for information delivery develop

The NRM Spatial Hub – underpinning better management decisions in the rangelands

Michael Digby^A, Russell Lethbridge^B, Phil Tickle^C Lee Blacklock^A, Kate Forrest^A and Dan Tindall^D

^ARangeland NRM Alliance,
E: rmsc@northerngulf.com.au, M: 0428 611 599

^BWerrington Cattle Co.

^CCooperative Research Centre for Spatial Information,
M: 0437 593 037

^DQueensland Government

The NRM Spatial Information Hub (The Hub) is a central element of the 15 year blueprint of the Australian Rangelands Initiative. The aim of the Hub is to provide land managers with systems, tools, data, and skills needed to dramatically improve access to property-scale information and knowledge.

The Hub initiative commenced in April 2014 and consists of 3 core elements:

The development and demonstration of a scalable on-line property planning and information system.

Coordination, information delivery, training and extension.

Demonstration and evaluation of current best-practice in the use of remote sensing for property planning and monitoring of pasture production and land condition at clusters of properties in each region.

The on-line property planning and information system (OPPIS) will provide land managers, plus Rangelands regional bodies with appropriate data and mapping tools to enable the consistent development and maintenance of comprehensive digital property plans, infrastructure maps, grazing plans and mapping of on-ground works. It will also provide secure on-line access to authoritative spatial data such as high resolution and time-series satellite imagery and tools for analysis and reporting.

Stage 1 of the Hub is demonstrating and evaluating the potential uses of the latest capabilities in time-series remote sensing of land condition. Customised tools and interfaces will then be developed which will enable land managers to undertake the analyses on-demand when the Hub is fully operationalised.

This presentation will provide an overview of the specific developments, plus also provide a graziers perspective of the system.

Preference of range plant species as assessed by pastoralists' perception and actual empirical determinations in a semi desert area in Sudan

Mohammed Abdelkreim^A and Babo Fadlalla

^ASudan University of Science and Technology,
www.sustech.edu. E: abdelkreim1979@gmail.com

KEYWORDS: pastoralists, botanical composition, relative preference index, bite count

This study was conducted at North Kordofan area, Sudan during rainy season of 2009/2010 at flowering stage. The study aims to provide information that contributes to a better understanding of the sustainability of herbivore populations in the open shrub rangeland of North Kordofan, Sudan using pastoralists' perceptions and empirical methods. Two range sites were selected: El-Rosa enclosure and a control in the open area nearby. The perceptions of pastoralists were investigated through the collection of data from the livestock raisers, using a questionnaire and group discussions. Botanical composition of the diet of sheep was determined using the bite count technique. There was reasonable agreement between our experimental findings and pastoralists' perceptions regarding plant preference by sheep. Plants that had high relative preference index (RPI) from the bite count method and were also cited by pastoralists as preferred in the two sites were *Desmodium* spp. (RPI=15.9), *Ipomea eriocapa* (RPI=15.7), *Echinochloa colonum* (RPI=5.1) *Zornia glochidiata* (RPI=3.9), and *Cenchrus biflorus* (RPI=1.68). Findings from pastoralists indicated that 57.5% of those interviewed considered *Zornia glochidiata* as a preferred plant while 70% of respondents reported that *Sida cordifolia* was undesirable plant.

The study concludes that pastoralists' perceptions give reasonable valuation for plant quality and may be taken as a measure of preference in certain instances. Information from pastoralists' perceptions may assist in making quick management decisions when resources of time and funds are limited and do not allow detailed classical studies. Plant preference studies such as those reported here allow ranking of range plant species with respect to preference, so that plants with high RPI can be used in further studies to assess other quality attributes such as tolerance to water stress, grazing pressure and fire. Plants can then be propagated and used in reseeding of degraded rangelands.

Dorper sheep in southern Australian rangelands: production success or environmental concern?

Y. Alemseged^{AD}, R. B. Hacker^B, G. Melville^A, A. Mitchell^C, I. Toole^A and W. Smith^A

^ANew South Wales Department of Primary Industries,
PMB 19, Trangie NSW 2823, Australia

^BRon Hacker Rangeland Consulting Services,
29 Edward St, Tenambit, NSW 2323 Australia

^CAustralian Museum,
6 College Street, Sydney, NSW 2010 Australia

^DCorresponding author. E: yohannes.alemseged@dpi.nsw.gov.au

The downturn in wool prices in the 1990's coupled with the lower cost of sheep meat production compared to wool production have encouraged more and more graziers in the rangelands to turn to Dorper sheep. The success of the breed has resulted mainly from its reputation as an adaptable animal that can produce marketable lambs under less than ideal pasture conditions and perceived easy care. While the Dorper breed of sheep offers important production advantages, little is known from research under Australian conditions about their grazing ecology and management requirements from a natural resource perspective. Field and laboratory experiments were undertaken to quantify the grazing behaviour, diet selection and field metabolic rate of Dorper sheep in relation to Merino sheep and assess the likely impact on natural resources. Results indicate that Dorpers select wider variety of species, including browse species, than Merinos. The wider range of plant species selected by Dorpers compared with the traditional Merino breed potentially creates both opportunities and risks for rangeland condition. Less selective grazing may reduce pressure on some species but the capacity to harvest sufficient nutrients over a smaller area could concentrate grazing and promote resource degradation.

Impact of grazing management on ground cover and domestic stocking rate under Holistic Management

Y. Alemseged^A, C. Waters, G. Melville, Warren Smith, and I. Toole

New South Wales Department of Primary Industries,
PMB 19, Trangie NSW 2823, Australia

^ACorresponding author. E: yohannes.alemseged@dpi.nsw.gov.au

Ground cover is a major factor that determines the extent to which soils are susceptible to wind erosion. By reducing the proportion of bare soil, land management can either moderate or reduce wind erosion rates. To study the impact of management, ground cover was assessed using the 'Step Point' method in 20 0.5 ha plots in 20 paddocks on a property using cell grazing (Holistic Management). Ground cover was assessed for nine years (at the time when ground cover was expected to be at its lowest in the region, October). The study site was located in north western NSW on Bokhara Plains and was included in the Enterprise Based Conservation program run between 2004 and 2013. Individual paddock stocking records were used to determine the annual domestic stocking rate changes under Holistic Management and were compared with the safe stocking rate for the region calculated using the GRASP model. Ground cover increased by 33% above the regional threshold in the final year of the project period. Regression analysis indicated 63% of the increase was due to rainfall. On average ground cover increased by about 8% each year above that expected based on rainfall. The actual and predicted stocking rates (DD/H/Year) and ground cover (%) shows HM achieved very close result to the safe stocking rate for the region. This suggests that altering grazing intensity and duration may have a beneficial impact on ground cover while enterprise profitability is uncompromised.

VegMachine® in Queensland

Terry Beutel^A, Robert Karfs^B, Jeremy Wallace^C, Peter Scarth^D, Rebecca Trevithick^E and Dan Tindall^F

^ADepartment of Agriculture Fisheries and Forestry,
PO Box 6014 Parkhurst Qld 4702. E: terry.beutel@daff.qld.gov.au. Ph: 07 4923 6232.

^BDepartment of Agriculture Fisheries and Forestry,
GPO Box 267 Brisbane Qld 4001. E: robert.karfs@daff.qld.gov.au. Ph: 07 3255 4325.

^CCSIRO Computational Informatics,
Floreat, WA 6913. E: jeremy.wallace@csiro.au. Ph: 08 9333 6292

^DDepartment of Science Information Technology Innovation and the Arts.
GPO Box 5078 Brisbane Qld 4001. E: rebecca.trevithick@dsitia.qld.gov.au, Ph: 07 3170 5679

^EDepartment of Science Information Technology Innovation and the Arts.
GPO Box 5078 Brisbane Qld 4001. E: rebecca.trevithick@dsitia.qld.gov.au, Ph: 07 3170 5679

^FDepartment of Science Information Technology Innovation and the Arts.
GPO Box 5078 Brisbane Qld 4001. E: dan.tindall@dsitia.qld.gov.au, Ph: 07 3170 5688

KEYWORDS: VegMachine, ground cover, monitoring, remote sensing

The VegMachine® software was developed in 2002 by a national team of RD&E providers, and funded by Meat and Livestock Australia. The software was designed primarily as a vegetation cover monitoring tool for graziers and agencies, to summarise and benchmark cover change over long periods at user specified locations. As such, it was ahead of its time, and even today, few comparable platforms exist. A large part of the software's use and development has occurred in Queensland, and this paper summarises that history including recent moves to an online tool.

Over 12 years, VegMachine has been trialed in a variety of programs by a number of Queensland agencies and pastoralists. It has been used to monitor and interpret rangeland change, engage pastoralists, and assess eligibility for NRM funding. It underwent major software and training material upgrades between 2008 and 2010. It can interrogate any suitably formatted raster time series, but in Queensland has focussed largely on Queensland Ground Cover Program products.

This range of experience has provided a number of insights about the use of landscape scale time series data in rangeland management. Most notably;

- NRMs have adopted the software very effectively, but largely for project assessment.
- Graziers adoption has been limited, for reasons of both supply and demand.
- A simple online form of the tool would dramatically widen pastoralist access and use.
- It would however require quality support materials and networks.

In 2014 work began on an online VegMachine tool. The online tool will deliver similar analysis to the PC software, but should improve land holder access, provide an effective set of training and support materials, integrate with existing programs like Grazing BMP and NRM Spatial Hub, and allow for future expansion and upgrades.

Using business analysis to inform management decisions in beef businesses

Kiri Broad^A, Timothy Emery^B, Roger Sneath^C, Ian McLean^D and Steven Bray^E

^ADepartment of Agriculture, Fisheries and Forestry,
PO Box 519 Longreach, Qld 4730. E: kiri.broad@daff.qld.gov.au, M: 0428 102 841

^BDepartment of Agriculture, Fisheries and Forestry,
PO Box 308 Roma, Qld 4455. E: timothy.emery@daff.qld.gov.au, M: 0408 707 155

^CDepartment of Agriculture, Fisheries and Forestry,
PO Box 102 Toowoomba, Qld 4350. E: roger.sneath@daff.qld.gov.au, Ph: 07 4688 1244

^DBush Agribusiness,
PO Box 41 Withcott, Qld 4352. E: ian@babusiness.com.au, M: 0401 118 191

^EDepartment of Agriculture, Fisheries and Forestry,
PO Box 6014 Red Hill, Qld 4701. E: steven.bray@daff.qld.gov.au, M: 0428 103 072

KEYWORDS: business analysis, benchmarking, profitability, productivity, climate change

Beef producers in northern Australia are struggling to cope with climate extremes and have experienced poor and declining profitability over the last decade. Producers on their own have difficulty assessing whether their business performance is 'just the state of the industry' or whether there are opportunities to significantly improve performance and join businesses who are coping much better. The Climate Clever Beef project in the Maranoa-Balonne region used a producer group to facilitate peer learning and assist with improved knowledge transfer amongst group members. Nine beef businesses, of the total twelve properties involved in the project, undertook a business analysis over three financial years, 2011-12, 2012-13 and 2013-14. The business analysis assessed current business performance, identified shortfalls in the business and assisted with setting the future direction and goals.

An industry consultant was engaged to support producers to compile the required business data and return reports detailing key performance indicators including: kg beef produced per adult equivalent, cost of production, operating margin and labour efficiency. Each business received their own report and a combined whole group report. An annual group debrief day enabled sharing and discussion of the performance of each business as benchmarked against the other businesses in the project, the group average and against average and top 25% benchmark data for northern Australia.

The reports and group discussion helped assist individual producers to redefine their management goals and identify where to make modifications and changes in the business. The process has encouraged practice change in 5 of the 9 businesses. For example two properties have undertaken management changes to improve reproductive performance by pregnancy testing cattle to identify and sell non-performing breeders improving cash flow, saving valuable pasture during the current drought for remaining productive livestock and reducing the greenhouse gas intensity of production.

(Student). Assessment of rangeland degradation caused by *Opuntia*-invasion in semi-arid zones of South Africa, implications on grazing strategies, carbon sequestration and agricultural land values

Lukas Chipfupa^A, PhD candidate, Florence V Nherera^B and Pieter Fourie^A

^ACentral University of Technology, South Africa,

^BAgricultural Research Council - Animal Production Institute (ARC-API), South Africa

KEYWORDS: rangeland degradation, *Opuntia humifusa*, stocking level, SNAP model, carbon sequestration

Rangeland degradation causes losses in herbaceous legumes and palatable grass species. The changing landscape in the Western Free State reflected by the overwhelming invasion of *Opuntia humifusa* could be attributed to rangeland degradation as a result of climate change and under-preparedness in veld managers to manage grazing environments. Intervention is important to prevent permanent ecological changes and depreciation of agricultural land values. The rangeland and soil degradation affects the capacity of rangeland as a carbon sequester and carbon sink. The aims of this study are to assess extent of *O. humifusa* invasion, the most rapid method of spread, determine rate of loss in species diversity; model range degradation based on variance in carrying capacity and carbon sequestration potential and propose veld utilization strategies to optimize ruminant livestock production. A grazing trial, using a split plot design with stocking rates as treatments, using cattle and sheep will be done in *O. humifusa* invaded camps. The level and extent of rangeland utilization will be assessed by mapping ecological trends. Modeling software will be used in predicting utilization capacity and also estimate changes in economic value of the Western Free State rangelands. A Serengeti National Park (SNAP) model will be validated and adapted to predict reduction in carbon sinking capacity of degraded rangelands. Appropriate analyses will be done using the ModelEval software and also statistical tests to determine variances. Outcomes of this research will contribute to development of rehabilitation strategies for managing destroyed environments and also minimizing new invasions. The data will also be utilized for modeling semi-arid environments to monitor new invasions, changes in ecological balances and implementation of appropriate intervention strategies that would promote meat and wool production in arid rangelands of South Africa.

Abnormal reproductive observations for beef cows on arid rangelands, associated with suspected increase in dietary phytoestrogens

J. Coventry^A, P. Jobson^B and C. Allan^A

^ADepartment of Primary Industry and Fisheries,
PO Box 8760, Alice Springs NT 0871.
E: jocelyn.coventry@nt.gov.au

^BDepartment of Land Resource Management,
PO Box 1120, Alice Springs NT 0871

KEYWORDS: arid rangelands, phytoestrogens, extensive-grazing, cattle, calving

Abnormal vulvar enlargement was observed one to eight weeks prior to calving for 72% (24/33) of a group of young beef cows on a research station in the Alice Springs district; those cows had a higher proportion of perinatal calf loss (6/24) compared to that of the other nine cows (1/9). Given circumstantial evidence about the seasonal arid rangeland diet, it is hypothesised that dietary phytoestrogens had a biological impact on the pre-calving hormonal cascade of the cows, and this was associated with untimely change in the external reproductive tract, plus increasing risk of perinatal calf loss. Analyses of rangeland feed and epidemiological data are required to test this hypothesis.

What distance from water should we use to estimate paddock carrying capacity?

Robyn A Cowley^A, Dale Jenner^B and Dionne Walsh^A

^ADepartment of Primary Industry and Fisheries,
GPO Box 3000, Darwin NT 0801.
E: robyn.cowley@nt.gov.au, M: 0419 829 493

^BDepartment of Primary Industry and Fisheries,
PO Box 8760, Alice Springs, NT, 0871.
E: dale.jenner@nt.gov.au, Ph: 08 8951 8152

KEYWORDS: grazing radius, watered area

Large, extensively grazed paddocks in Australian rangelands are often poorly watered, which causes overgrazing close to water and relatively ungrazed areas further from water. To adjust for watered area when estimating carrying capacity, estimates within 0 to 3 km and 0 to 5 km from water are typically used. We calculated the proportion of total forage consumed with distance from water in grazing trials in the Victoria River District and Barkly regions of the Northern Territory, by multiplying average defoliation estimates within 500m distance to water (DTW) bands by area of DTW bands. Cattle grazed further from water in less well watered paddocks, with more cattle per water point and with lower available forage per head. 90% of grazing occurred within 3km of well watered paddocks but within 5km from water in poorly watered paddocks. However, even in large poorly watered paddocks at least 70% of grazing occurred within 3km from water. This study confirms our current approach of calculating carrying capacity within a 3km grazing radius in well watered paddocks. Applying a 5km grazing radius when calculating carrying capacity in poorly watered paddocks will account for the greater distances travelled by cattle in these circumstances, but will result in very high utilisation and poor land condition closer to water, and is not recommended.

(Student). Dynamics and distribution of grazed patches under different stocking strategies in tropical savanna rangelands

M.H. Dekkers^A, P.J. O'Reagain^B, D. Tindall^C and D.P. Poppi^A

^AUniversity Of Queensland, School of Agriculture and Food Science,
Gatton, QLD. E: m.dekkers@uq.edu.au

^BDepartment of Agriculture, Fisheries and Forestry,
Charters Towers, QLD

^CDepartment of Science, Information Technology, Innovation & the Arts,
Remote Sensing Centre, Brisbane, QLD

KEYWORDS: ground cover, overgrazing, selective grazing, species composition, landscape function.

Rangelands account for over 80% of Australia's landmass and support a diverse range of vegetation. Livestock grazing is an integral and important part of Australia's rangeland environments and a significant contributor to the Australian economy. Patch or selective grazing by livestock can affect the ecohydrology within the rangeland system. Soil and nutrient loss due to water run-off from overgrazed or poor condition patches can have major consequences for the amount and quality of pasture produced, and hence cattle production. Increased runoff and soil loss are also of major significance for landscape degradation and water quality in catchment areas such as those which adjoin the Great Barrier Reef. The impacts of patch grazing have been well studied at a number of sites across the country and around the world. However, relatively little work has been undertaken at multiple scales to understand temporal and spatial relationships between patch dynamics, patch distribution, climate variability and the grazing strategy employed. There is a clear need for further research to improve our understanding of the impacts of patch grazing on vegetation dynamics at the paddock scale under different grazing strategies and how this affects landscape condition and function at the regional or catchment scale.

This study forms part of a PhD project which will investigate changes in patchiness in grazed paddocks using a combination of ground measurements, remote sensing techniques and historical data. The study will be conducted at a long term grazing trial located at Wambiana station, 70 kilometres south of Charters Towers, North Queensland. The site includes ten paddocks between 93-117 hectares each with five different grazing strategies replicated twice. The results from this research will be important in understanding how different grazing strategies affect patchiness as well as its consequences for landscape function and cattle production.

'RANGEWATCH': An NDVI based method of estimating forage biomass in northern Australia. A case study in the western Kimberly region of Western Australia

Graham Donald^{AC}, Richard Stovold^{AB}, Norman Santich^{AB}, David Lamb^{ACE} and Charity Mundava^{AD}

^ACooperative Research Centre for Spatial Information,
Carlton South, Victoria 3053, Australia

^BWestern Australian Land information Authority,
Landgate, Floreat, Western Australia 6014, Australia

^CPrecision Agriculture Research Group,
University of New England, Armidale New South Wales 2351, Australia

^DDepartment of Spatial Science,
Curtin University, Bentley, 6102 WA, Australia

^ECorrespondence: David Lamb, Precision Agricultural Research Group, University of New England, Armidale, New South Wales, Australia, 2351. Email: dlamb@une.edu.au

KEYWORDS: rangeland management, pasture utilisation, remote sensing, biomass assessment, pasture growth, stocking numbers

An understanding of the current amount of total green biomass, total biomass and biomass growth rates is necessary for graziers to better manage pasture utilisation in the northern Australian grasslands. This project aims to assess the veracity (and challenges) of applying MODIS satellite-derived NDVI to calculating forage biomass in the complex landscapes of the northern tropical rangelands and to develop a web-based delivery platform providing forage estimates to producers ('Rangewatch'). The study site was located on a ~263 km² cattle station, located 250 km south east of Derby in Western Australia, on the Fitzroy River. All site locations were sampled during the 2011-12 and the 2012-13 growing seasons. In this study MODIS satellite NDVI image and climate data were used to produce estimates of pasture total green biomass (RMSE \pm 825 kg DM/ha) and total biomass (green + dead) (RMSE \pm 1050 kg DM/ha) with a ~6.25 ha (250 m²) pixel resolution.

Improving performance through adaptive grazing: Beetaloo Station

Jane Douglas^A, Dionne Walsh^A, Kate Christianson^B and Jane Armstrong^C

^ANT Department of Primary Industry & Fisheries,
PO Box 159, Tennant Creek, NT 0860.
E: jane.douglas@nt.gov.au

^BBarkly Landcare & Conservation Association,
PO Box 159, Tennant Creek, NT 0860.

^CBeetaloo Station, PMB, Elliott, NT 0862

KEYWORDS: rotational grazing, pasture utilisation, sustainability, intensification

Uneven utilisation of pastures is an issue facing extensive cattle properties in the Northern Territory. During the dry season most cattle need to return to water points to drink at least once a day. In large paddocks with few waters, this results in areas close to water being overgrazed and areas beyond the walking range of cattle being ungrazed. The subsequent decline in feed levels close to water is detrimental to animal production and land condition. The under-utilised pastures far from water are also an untapped resource that, if made accessible, can improve the profitability of a property.

A demonstration project at Beetaloo Station in the Barkly Region aims to evaluate how a more intensive rotational management system compares to “traditional” extensive, low development, continuous grazing pastoral management typical in the Barkly area.

The management changes implemented at Beetaloo have been selected specifically to increase agricultural productivity as well as protect and enhance conservation values. Key principles of the management approach are increasing carrying capacity by increasing watered area, and using high intensity short duration grazing with long periods of pasture rest.

The adaptive grazing demonstration has been gathering scientific evidence of what the pastures and biodiversity were like in the initial stages of the management program and how they are changing over time. Animal live weight gain and economic performance are also being evaluated. The aim is to ascertain the potential for sustainably and profitably intensifying production through grazing practices that give greater control of livestock distribution, grazing pressure and pasture utilisation.

Wet season spelling: a producer demonstration site

C. Harris^A, P. Jones^A and S. Bray^B

^AQueensland Department of Agriculture, Fisheries and Forestry,
LMB 6, Emerald, Qld 4720, Australia. E: carly.harris@daff.qld.gov.au

^BQueensland Department of Agriculture, Fisheries and Forestry,
PO Box 6014, Redhill, Qld 4701, Australia.

KEYWORDS: wet season spelling, land condition, pasture yield, vegetation

Wet-season spelling of grazing land is a key recommendation for improving land condition to benefit sustainability, production and profit in agriculture. The Spelling Strategies project aims to improve the evidence base and modelling reliability underpinning such recommendations. In addition to two research sites, located at Clermont and Charters Towers, a producer demonstration site has been established south of Duaringa in Central Queensland, to monitor the capability of wet season spelling of poplar box woodland to achieve land condition maintenance and/or improvement. Four vegetation states are each subjected to two grazing treatments - continuously grazed and wet season spelled. The vegetation areas being monitored include remnant box woodland, 10-year-old box regrowth, recently cleared 10-year-old regrowth and an area completely cleared of trees by Graslan herbicide 10 years ago. Data has been recorded for two wet seasons.

Compared to the continuously grazed plots, wet season spelling had higher pasture yield while ground cover remained high and stable across all treatments. Tussock crown cover appears to have only increased under spelling in the recently cleared regrowth and regrowth treatments indicating potential for land condition improvement. The remnant treatments showed little response with tree competition probably limiting pasture growth. Wet season spelling over two summers appears to have relatively quickly improved pasture yield across all treatments, however improvements are small and variable for ground cover and crown cover. Research conducted under the Spelling Strategies project at the Clermont property has shown similar results over the 2010/11 and 2011/12 wet seasons.

What determines recruitment success of trees on pastoral land in SE Australia?

Ken Hodgkinson^A, Warren Müller^B and Yanhua Zhang^C

^ACSIRO Land & Water, Canberra , Australia

^BCSIRO Digital Productivity & Services, Canberra, Australia

^CCollege of Life Sciences, Shaoxing University, Shaoxing, China

KEYWORDS: grazing, recruitment, landscape, salinity, native grasslands

Recruitment of Eucalypt species in pastoral paddocks, roadsides and areas of remnant native vegetation was determined at 325 sites throughout the southern Tablelands of NSW. Sites were found where there was recent recruitment and to these were added sites in adjacent areas that were differently managed. At each site the number of adult and juvenile Eucalypt trees present was recorded. In all 23 Eucalyptus species were found at the sites; four species were present at more than 50 sites and 12 species were present at 10 or less sites. In addition, at each site 28 variables describing the management, vegetation, landscape type, soil type and landscape functionality were determined.

Regression models were developed for the more abundant species to determine which site variables influenced both the presence and number of juvenile trees. In developing these models we had to consider the effect of a relatively high number of predictive variables compared to total numbers of observations, relationships between the predictor variables, and how the selected variables could be validated as true predictors of recruitment. We describe how we addressed these issues and present the variables that we believe were influencing recruitment of the most abundant tree species.

Burdekin rangelands Grazing BMP and Extension support project – practice change

Mellissa Holzward, Brigid Nelson, Tim Moravek and Joanna Robertson

Queensland Department of Agriculture, Fisheries and Forestry,
Charters Towers, Qld. 4820.

E: mellissa.holzward@daff.qld.gov.au, E: brigid.nelson@daff.qld.gov.au,
E: tim.moravek@daff.qld.gov.au, E: joanna.robertson@daff.qld.gov.au

KEYWORDS: project, rangelands, practice change, extension, water quality

This paper reports on the services and support delivered by the Queensland Department of Agriculture, Fisheries and Forestry (DAFF) to the Burdekin rangelands grazing industry from July 2011 through to June 2014. It outlines the achievements and activities undertaken specific to the Burdekin rangelands, Grazing Best Management Practices (BMP) and Extension Support Project.

The Grazing BMP and Extension Support project is part of the ongoing response aimed at reversing the decline in water quality in the Great Barrier Reef (GBR) World Heritage Area. The decline water quality is largely a result of land management practices in adjacent catchments over the past 150 years. Since 2003, the Australian and Queensland governments have partnered with industry, natural resource management and conservation organisations to deliver a series of Reef Water Quality Protection Plans (Reef Plan). The most recent Reef Plan is for the period of 2013 to 2018. A primary objective of Reef Plan is to reduce the level of nutrients, sediments and pesticides from agricultural lands entering the GBR by encouraging landholders to adopt better land management practices. This is to be achieved using a variety of mechanisms including incentives, regulation and extension services. The Burdekin rangelands Grazing BMP and Extension Support Project aims to support beef producers to adopt grazing systems that are productive and profitable with improved water quality outcomes in the GBR.

Expanding the range of control options for *Calotropis procera* (rubber bush) in the Barkly Tablelands

Meg Humphrys^A, Shane Campbell^B and Daniel Steel^A

^ADepartment of Land and Resource Management,
POX 846, Tennant Creek, NT, 0860.
E: Meg.Humphrys@nt.gov.au, Ph: 08 8962 4322, M: 0418 202 026;
E: Daniel.Steel@nt.gov.au, Ph: 08 8962 4314, M: 0418 617 020

^BDepartment of Agriculture, Fisheries and Forestry,
Tropical Weeds Research Centre, PO Box 187, Charters Towers, QLD, 4820.
E: Shane.Campbell@daff.qld.gov.au, P: 07 4761 5704, M: 0427 765 506

KEYWORDS: Calotrope, chemical, rangelands, threat, weed

The exotic shrub *Calotropis procera* (Aiton) W.T. Aiton (rubber bush) is spreading throughout the Barkly Tablelands Region (Northern Territory) where land managers are concerned about apparent impacts. Meat and Livestock Australia is funding a collaborative project, involving pastoral land managers, Charles Darwin University, the Northern Territory Government's Department of Land Resource Management and the Queensland Government's Department of Agriculture, Fisheries and Forestry. The project seeks to better understand the ecology and invasiveness of rubber bush in context to the threat it poses. The project is also evaluating control methods in Queensland, with several herbicide options using foliar, basal bark and cut stump techniques and ground or aerial applications of residual herbicides proving effective. A trial was established in May 2014 to test the relevance and effectiveness of these treatments under pastoral conditions in the Barkly Tablelands. Twelve herbicide treatments including a control were replicated three times. Metsulfuron-methyl, metsulfuron-methyl plus triclopyr/picloram, and 2,4-D amine treatments were applied by foliar spray, triclopyr/picloram was applied using both the traditional and thin line basal bark methods, and triclopyr/picloram, glyphosate, and a picloram gel were applied using the cut stump technique. Ground applications of the residual herbicides tebuthiuron and hexazinone were applied towards the end of spring prior to the onset of the wet season (summer). A demonstration of the aerial application of tebuthiuron was undertaken to show the potential of this technique for control of large dense infestations. Assessments of rubber bush damage and mortality were conducted at six months after application (November 2014) of the foliar, basal bark and cut stump treatments and further assessments will be conducted at 12 and 24 months. This paper presents the initial results from the herbicide treatments, and discusses indications for long-term control of rubber bush, and their potential suitability for use in the Barkly Tablelands.

Spelling strategies for recovery of pasture condition

Paul Jones^A, Carly Harris^A and Richard Silcock^B

^ADAFF LMB 6 Emerald Qld 4720.

E: Paul.jones@ddaff.qld.gov.au, Ph: 07 4983 7415;

E: Carly.harris@ddaff.qld.gov.au, Ph: 07 4983 7420

^BDAFF Ecosciences Precinct,

GPO Box 267, Brisbane Qld 4001.

E: Richard.silcock@ddaff.qld.gov.au, Ph: 07 3255 4295

KEYWORDS: spelling, condition, basal area, composition

This project seeks to improve the evidence base and modelling capacity underpinning recommendations for the 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. The spelling strategies research now has four years of information from the Monteagle site near Clermont, and two years from the Wambiana site south of Charters. Spelling has produced a small, yet significant improvement in the basal area of the key perennial grass *Bothriochloa ewartiana* when compared to continuous grazing at moderate stocking rate. This improvement is too small to alter a land condition rating, but does demonstrate the beneficial processes due to spelling. Lack of a sizeable viable significant viable seed bank for *B. ewartiana* underpins a lack of new seedlings establishing and is therefore a major contributor to the lack of demonstrable land condition improvement. Both sites have a large amount of wiregrass in the pasture which may possibly be reduced by controlled burning to assist land condition improvement. Since spelling began, Monteagle has had two years of very good rainfall, followed by two very dry years while the Wambiana site has had one average, and one below average rainfall year. The Monteagle site was destocked over the 2012/13 summer following a wildfire through the trial paddock in November 2012 and very dry conditions. At Wambiana, the research is conducted under a moderate, or a high stocking rate. Data from the 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. Spelling to improve land condition will take many years and must be in synergy with grazing best management practices.

A diary of a new bore

Helen McMillan^A, Dionne Walsh^B and Casey Collier^A

^ADepartment of Primary Industry & Fisheries,
PO Box 159, Tennant Creek NT 0861.
E: Helen.McMillan@nt.gov.au, Ph: 08 8962 4486;
E: Casey.Collier@nt.gov.au, Ph: 08 8962 4493

^BDepartment of Primary Industry & Fisheries,
GPO Box 3000, Darwin 0801.
E: dionne.walsh@nt.gov.au, Ph: 08 8999 2178

KEYWORDS: stocking rate, pasture spelling, Mitchell grass, yield, cover

This poster is a case study on the changes in pasture yield, cover and defoliation after the establishment of a new bore. This case study is part of a larger, long-term stocking rate and wet season pasture spelling trial currently being conducted on the Barkly Tablelands in the Northern Territory. The trial bores have had pasture species, yield and cover data collected annually since 2011 at 13 points along a transect line out to 5000 m from each bore.

The development of a piosphere is becoming apparent, with grazing impacts observed out to 1000 m from the new bore. Average ground cover from 2011 to 2014 has almost halved and average pasture yields have declined between 1000-2000 kg/ha along the transect line. As expected, defoliation scores have increased. A contributing factor to the significant declines over a short period of time was a below average 2012/13 wet season and an average 2013/14 wet season. Long-term sustainable stocking rates are practiced on this property, however it has become apparent how rapidly pasture yield and cover can decline in new grazing areas in years with lower rainfall. The next aspect of investigation for this trial would be to implement a wet season spell at the new bore to determine if pasture and land condition impacts can be reversed

Quality Graze trial: grazing strategies impact on land condition and premium beef production in central Australia

Chris Materne

Department of Primary Industry and Fisheries,
PO Box 8760, Alice Springs, NT, 0871

KEYWORDS: land condition, grazing strategy, sustainable pastoralism

Managing feed quantity and not quality is the limiting factor to consistent premium beef production in central Australia. It is also a critical factor in land condition recovery and optimising sustainable cattle production and business resilience in a variable and changing climate.

The strength of the central Australian beef industry, as identified by the Alice Springs Advisory Committee (ASPIAC), is the ability to produce fast growing *Bos taurus*-dominant cattle from high quality native pasture, and, access to southern premium beef markets. But how can we take advantage of these strengths in an extremely variable and unpredictable climate?

One marketing option is the production of finished steers for slaughter and premium prices through the Meat Standards Australia (MSA) meat quality grading system. However, meeting this market option consistently is challenging.

Data from the Department of Primary Industry and Fisheries suggests consistent fattening of young cattle regardless of season in central Australia is theoretically possible if feed quantity is managed. However, to meet premium beef markets the industry needs to know the costs, what management changes are required and the conditions under which such a production strategy is profitable.

The grazing system adapted to managing available pasture is a key component. Therefore with the support of ASPIAC, the long-term Quality Graze trial (>10 years) has been implemented on the Old Man Plains Research Station (OMP) 20km south of Alice Springs. The trial aims to test the impact of recent grazing strategy research recommendations, flexible stocking rate management and pasture rest, on land condition, quality beef production and business profitability. The production goal of the trial will be the consistent production of 2-2½ year old grass fed steers, trucked direct to slaughter for MSA grading, regardless of season.

Welcome to the journey – finding the production answers with the producers

Chris Materne and Jane Tincknell

Department of Primary Industry and Fisheries,
PO Box 8760, Alice Springs, NT, 0871

KEYWORDS: research extension, producer engagement, sustainable pastoralism

Research is a journey of discovery and producer engagement in research is critical to ensure projects meet a timely need and that the subsequent recommendations are adopted by industry.

In 2011 the Quality Graze trial was implemented on Old Man Plains Research Station (OMP), Alice Springs, Northern Territory to investigate the feasibility of consistently supplying grass-fed beef to premium markets. In 2014, with the aim to directly involve producers in cattle and grazing research, Meat and Livestock Australia (MLA) funded a producer demonstration site (PDS) at OMP. The PDS took form as a friendly producer challenge of locally bred steers. This project tapped into the producers' competitive nature by providing a neutral venue for producers to compare their steer performance under the latest industry grazing land management recommendations.

Up to eight 200kg steers from seven properties and encompassing ten breeds and cross-breeds of cattle have joined the twenty Quality Graze trial research steers to be grown out to 2½ years. The steers are prepared and sent directly to slaughter where they are graded against Meat Standards Australia criteria. Their performance whilst at OMP is monitored both manually and with a Remote Livestock Management System. The steer's journey is analysed by researchers and producers alike with the aim to identify potential improvements to the production system.

This PDS allows producers to travel the journey of discovery with researchers.

Achieving greater pastoral profit

Meat & Livestock Australia and Australian Wool Innovation

Corresponding author: Pene Keynes, National Coordinator Pastoral Profit, Rural Directions Pty Ltd, 9 Strickland Street, Clare, SA, 5453. E: pkeynes@ruraldirections.com, Ph: 08 8841 4500

Pastoral Profit is a new extension program which directly addresses the challenges posed by many pastoral livestock producers. It targets business management skills to improve bottom lines, expanding extension services and methods of delivery which take into account the large distances to regional centres, and creating tailored resources for the pastoral zone. The program is funded by Meat & Livestock Australia and Australian Wool Innovation, and if you would like to find out more, or participate as a producer, technical deliverer or partner contact pkeynes@ruraldirections.com.

Pastoral Queensland cattle producer, MLA Challenger from 2014 and Pastoral Profit advocate, Andrew Miller, knows first-hand how enhanced business management skills leads to more informed decision making and consequently can lead to greater business success. Andrew identified the increased complexity associated with running a grazing enterprise in a tough pastoral environment. Better management, through making informed business management decisions, allowed the business to survive through the tough seasons and Megan and Andrew feel much better off because of it. "Now our decisions are well researched, informed and defensible, and they get us the results we're after."

Andrew and Megan credit having a drought management plan and having business management processes in place. Addressing inevitable decisions early such as destocking and forging a drought management plan helped alleviate stress and anxiety and relieve some of the pressure on their business, particularly with the uncertainty of drought.

Andrew says "I am excited to be involved with Pastoral Profit because I believe it will be a great resource that I can use to help improve my business as a whole." In collaboration with regional partners, Pastoral Profit will be delivering training to build the knowledge and skills of pastoralists to adopt improved business management skills applicable to their region and situation.

Economic impacts of rehabilitating degraded lands in the Burdekin catchment

Moravek, T.^A and Hall, T.J.^B

^AQueensland Dept. of Agriculture, Fisheries and Forestry,
Charters Towers, Qld. 4820. E: timothy.moravek@daff.qld.gov.au Ph: 07 4761 5150

^BQueensland Dept. of Agriculture, Fisheries and Forestry,
Toowoomba, Qld. 4350. E: trevor.hall@daff.qld.gov.au

A field trial was established in 2011 at the Spyglass Research Facility, 130 km west of Townsville in the Burdekin Catchment, to investigate the efficacy of mechanical interventions of varying intensities to regenerate bare D-condition grazing land. Mechanical interventions evaluated were deep ripping, chisel ploughing and crocodile seeding, compared with an undisturbed control. All treatments were seeded with an exotic tropical grass and legume pasture mix. The broad landtype at the site was a loamy alluvial, considered to be of medium fertility, however, there were three soil types across the site, two of which were of low fertility. The success of each disturbance method, assessed by potential economic outcomes from grazing cattle on the regenerated pasture, was measured through pasture yields and the composition of grasses and legumes grown in each treatment.

The analysis used the trial results over three years to quantify the economic outcomes for beef producers. Cost varied greatly between the interventions, as did the resulting pasture dry matter yields and legume composition. Deep ripping cost \$261/ha and grew an average of 3080 kg/ha, chisel ploughing cost \$211/ha and grew 2500 kg/ha, and crocodile seeding was cheapest at \$151/ha and grew the least amount of dry matter, 1300 kg/ha.

A forage budget based on total annual pasture yields and legume composition at the end of summer was used to calculate the potential liveweight gain and stocking rates on an annual basis, and a steer trading model was used to assess the relative returns between each treatment and the control. The net present value (NPV) and an internal rate of return (IRR) were calculated for each disturbance method.

On a pure economic basis, the analysis showed that no treatment was economically viable at the 10% discount rate, resulting in negative net present values. IRRs were very close between the treatments with chisel ploughing achieving an IRR of 4.55%, crocodile seeding with 4.37% and deep ripping at 4.36%. This analysis did not take into account public benefits, such as improved water quality, which is an important outcome for the health of the Great Barrier Reef. It is recommended that producers investigate external grant options to subsidise the cost of restoring D-condition land. This trial demonstrated that, given good initial establishment, it is possible to quickly rehabilitate land; however, it may come at an economic cost to producers. More details of the pastures and environmental outcomes can be found in the full Project (RRRD.024) report.

Burdekin Grazing BMP and extension support project – a cost benefit analysis

Moravek, T. and Nelson, B.

Queensland Dept. of Agriculture, Fisheries and Forestry, Charters Towers, Qld. 4820
E: timothy.moravek@daff.qld.gov.au, brigid.nelson@daff.qld.gov.au Ph: 07 4761 5150

KEYWORDS: project evaluation, economics, extension and education, grazing bmp.

This paper reports on the results of a cost benefit analysis (CBA) done for the DEHP Burdekin Grazing BMP and Extension Support project. Over the first three years of the project, the project engaged with 272 producers managing 842,052 cattle.

The CBA was performed from the Queensland Government's perspective and used project budgets as costs. Monitoring evaluation data collected throughout the project and internal case studies which covered grazing land management, animal production and business management were used in assessing benefits. A sample of producers were surveyed to ascertain real practice change made as a direct result of the program.

Project costs totalled \$900,000, \$960,000 and \$985,000 in years one, two and three, respectively. Recorded practice change was 73.3% at final evaluation and average profitability from internal case studies suggested net benefits were \$12.25/head.

A "with" and "without" scenario were developed and the relative benefits parsed through a discounted cashflow analysis to ascertain net present value (NPV) and cost benefit ratio of the program. The "with" scenario used the costs, adoption levels and benefits mentioned above over a 10 year time frame. The "without" scenario assumed that adoption and benefits were the same as the "with" scenario, however, were delayed by 5 years. This, in effect, meant that benefits of the project were neutral after 5 years. ADOPT (Kuehne, 2013) scenarios were performed to check the accuracy of adoption levels without extension and the levels used were found to be reasonable. The results of the CBA showed that present value of costs was \$2.53 million (2011 dollars) and present value of relative net benefits was \$8.73 million, resulting in a NPV of \$6.2 million dollars and a cost benefit ratio of 3.45. Sensitivity analysis showed that per head benefits could fall to \$3.55 before benefits failed to cover investment costs. This analysis focused on producer benefit and did not include expected environments benefits, such as water quality improvement.

REFERENCE:

Kuehne, G. L. (2013). ADOPT: the Adoption and Diffusion Outcome Prediction Tool (Public Release Version 1.0, June 2013). Adelaide, SA, AUS: CSIRO

Fifty years of monitoring pastoral lands in central Australia – the Cunningham sites

Camilla Osborn

Centralian Land Management Association
Ph: 08 8953 4230. E: clma@clma.com.au

KEYWORDS: Keywords: monitoring, sites, central Australia, Cunningham, pasture

2015 marks fifty years since the establishment of what are now known as Cunningham sites. Cunningham sites are located on properties throughout the central Australian section of the Northern Territory and were first set up in the 1960's to ensure appropriate carrying capacities and understand the soil erosion issues in the area (CLMA 2003). In the early 90's these sites were again located by Geoff Cunningham, hence the name. Initially these sites were not marked so only through Cunningham's detailed notes and photographs 158 sites were relocated and re-monitored (CLMA, 2006). In the early 2000's as part of the NHT funded Centre Land Watch program, Cunningham sites as well as Tier 1 and RCA sites were re-monitored by the Centralian Land Management Association (CLMA) with landholders.

In the 1960's after a long drought some thought that the trees, shrubs and pasture plants would never recover (Walsh, 2003). Today an increase in woody species is evident at many sites as well as Buffel grass.

Fifty years on from their establishment the CLMA is endeavouring to re-monitor all 158 Cunningham sites. This is occurring as part of the resurrected Centre Land Watch program. Site assessment will be carried out with land managers to encourage their interest in monitoring and provide assistance with any information needed such as plant id, data collection and storage of data, as well as gaining their assistance with site relocation and management history.

REFERENCES:

D. Walsh, R. Dance and R. Grant (2002) *Forty years of monitoring pastoral lands in central Australia* in Conference proceedings, Australian Rangeland Society Conference, Kalgoorlie, WA.

CLMA (2003) *Develop Centre Land Watch, A Pastoralists Natural Resource Monitoring Program* NHT Final report.

How well does NDVI correlate with green biomass, cover and diet quality?

David Phelps^A, Ian Houston^B and David Counsell^C

^ADepartment of Agriculture, Fisheries and Forestry,
P.O. Box 519, Longreach Qld 4730.
E: david.phelps@daff.qld.gov.au

^BDepartment of Agriculture, Fisheries and Forestry,
P.O. Box 519, Longreach Qld 4730.
E: ian.houston@daff.qld.gov.au

^CDunblane, Barcaldine QLD 4725.
E: davidjcounsell@bigpond.com

KEYWORDS: NDVI, Mitchell grass, diet quality, livestock productivity

Diet quality and forage biomass are key determinants of livestock performance and stocking rates. Consultation with landholders in western Queensland has shown they desire improved tools to assess the quality and quantity of pasture on offer to adjust stocking rates, predict live-weight gain or loss and provide timely protein and energy supplementation.

Green pasture is of higher quality than senesced or moribund pasture – but does this mean it is a good surrogate for pasture quality? We have tested the relationship between NDVI (Normalised Differential Vegetation Index), green biomass, green cover, faecal estimates of protein and metabolisable energy and sheep liveweight change over two years in Mitchell grass pastures of western Queensland.

This paper presents preliminary findings and discusses the potential for NDVI to estimate green biomass and cover and how well this relates to diet quality and liveweight change.

Potential for innovations in pastoral management, ecological recovery and governance in the Nullarbor region of Western Australia

Rodney D. Safstrom^A and Paul Novelty^B

^ADepartment of Agriculture and Food Western Australia,
3 Baron Hay Court, South Perth 6151.
E: rodney.safstrom@agric.wa.gov.au, M: 0402 287 811

^B3 Baron Hay Court South Perth 6151. Ph: 08 9368 3492

KEYWORDS: ecosystem, transition, sustainability, innovation, production, ecology

There are seemingly intractable ecological challenges confronting pastoralism in the Nullarbor region of Western Australia and impacting on pastoral productivity due to:

- Ecological changes so dramatic, due to pre-pastoralism impacts of rabbits and fire now exacerbated by pastoralism, contributing to replacement of perennial species by an annual component, and some areas so eroded they no longer provide suitable conditions for establishment of perennial plants.
- Changed economic conditions and reduced productivity in below average seasons creating pressure to maintain stock numbers impacting perennial vegetation and creating conditions for accelerated soil erosion.
- Lack of a common approach to sustainable pastoral management across governance systems including lease management, production knowledge sharing, landscape repair knowledge sharing and monitoring systems.

The original productive chenopod shrublands are fire sensitive and with repeated fires, combined with grazing by rabbits, kangaroos and domestic stock the perennial seed bank is lost. Woodlands and groves of trees that provided dry season forage with high metabolisable energy are being burnt out and further damaged through grazing. The causes of ecological changes are well understood. Pathways to recovery such as re-siting water points and spelling paddocks for extended periods are technically but may not be financially feasible. The economic imperative for short-term income is often at odds with long-term pasture sustainability. Current adaptations by the pastoral industry are generally not sufficient to address the ongoing ecological decline.

Production, monitoring and regulation support sectors in government tend to operate in silos. Proposed reforms by government to create leases with greater flexibility have limited potential on the Nullarbor due to its remoteness.

There are no clear directions for a sustainable ecological future for the pastoral industry on the Nullarbor. Business as usual, without rapid stocking adjustment to forage availability, is not ecologically sustainable. Creative solutions could come from forums involving all stakeholders designed to encourage mutual understanding and innovation.

Operator bias associated with visual assessments of pasture yield for forage budgets on native pasture

Nicole B Spiegel^{AC}, Peter O'Reagain^A, Angela Anderson^B and Megan R Willis^A

^AAgri-Science Queensland, Department of Agriculture and Fisheries,
PO Box 976, Charters Towers, Qld 4820

^BAgri-Science Queensland, Department of Agriculture and Fisheries,
Spyglass Beef Research Facility, MS 99, Charters Towers, Qld 4820

^CCorresponding author E: nicole.spiegel@daff.qld.gov.au

KEYWORDS: stocking rates, pasture photo standards, Stocktake Plus, palatable yield

Adjusting stocking rates based on pasture availability is a key recommendation for sustainable management of grazing lands. 'Stocktake Plus', an application for smart devices, has a forage budget component to assist graziers with stocking rate calculations. It requires an estimate of pasture yield, typically determined via visual means. Operator bias associated with visual assessments of yield and percentage of unpalatable yield was examined on three different landtypes in the late dry season of 2014 near Charters Towers. Ten operators assessed twenty-seven sites (each 25m²) representing a range in yields across the three landtypes. Operators had previous experience in estimating pasture yield and using pasture photo standards to assist with estimation. Actual pasture yields were objectively estimated by clipping three 1m² quadrats at each site.

There were different patterns amongst operators in their ability to visually estimate yield, such as greater variability in estimates over the range of yields encountered. In general, operators over-estimated yield when actual yields were low (especially those <1000kg/ha) and under-estimated yield when yields were high (>3000kg/ha for Box and Brigalow). A linear regression of the visual yield estimate against the number of estimates made, accounting for operator effects, was significant but very weak ($p < 0.001$, adj R^2 13%), indicating fatigue did not bias results. Operators also visually assessed the percentage of unpalatable pasture yield in terms of plant species and plant parts. The variation between operators for this assessment was as high as 100%.

Forage budgets based on visual estimates of pasture yield should thus be seen as approximate guides rather than precise estimates for calculating stocking rate. Further work is planned to develop methods for improving accuracy of visual assessments of pasture yield, particularly for large, spatially variable paddocks that are common in the northern beef industry.

Expansion of the exotic grass *Bothriochloa pertusa* on the Basalt of the Burdekin catchment

Raymond Stacey

Dalrymple Landcare Committee, PO Box 976, Charters Towers 4820

Present address: 985 Biddeston-Southbrook Road, Southbrook 4363, E: rjstacey01@bigpond.com, M: 0429 872 855

KEYWORDS: *Bothriochloa pertusa*, dominance, 3P Indicators, pasture composition, grazing.

Bothriochloa pertusa, an introduced, grazing adapted, stoloniferous grass has been expanding in north east Queensland since being introduced to the Bowen area in the mid 1900's.

For a number of years, graziers and extension staff have been reporting large increases in the amount of *B. pertusa* in the pastures of the Basalt region, north-west of Charters Towers. This has occurred under all grazing regimes.

1995 surveys of QGraze monitoring sites in the Basalt provide base line data to compare with the 2014 survey of 16 QGraze sites. Grazer surveys provided information on timing, pathways and events associated with *B. pertusa* expansion.

In 20 years, *B. pertusa* has expanded from zero recordings in 1995 to a mean frequency of 74% in 2014. *B. pertusa* now contributes one third of organic groundcover. As the percent frequency of *B. pertusa* increased the proportion of groundcover that *B. pertusa* contributed increased exponentially.

Significantly as the percent frequency of *B. pertusa* increased the frequency and plant density of 3P indicators decreased exponentially. There appears to be a threshold of 60-80% *B. pertusa* frequency at which this decrease accelerates. This is in spite of an overall, though variable, increase in the frequency of 3P Indicators.

Changes in grazing management, before this threshold is reached, could be critical to avoid moving to a *B. pertusa* dominated pasture. The presence of a seed source, heavy grazing events, coupled with drought and time, appear to be significant drivers.

Best Management Practice, a benchmarking process for the grazing industry

Michael Taylor^A and Peter Long^B

^AAgForce, Mary St Brisbane, Qld.

E: talyorm@agforceqld.org.au, Ph: 07 3238 6042

^BFBA, East St Rockhampton, Qld.

E: peter.long@fba.org.au, Ph: 07 4999 2841

KEYWORDS: Best Management Practice, industry standards, benchmarking, sustainability, partnership, industry developed

Australian livestock production systems are among the most efficient and sustainable in the world, with much of the production based on natural pasture systems on approx. 46% of Australia's land area. However, protecting the sustainability of the grazing industry into the future is a key responsibility for producers- and a vital part of ensuring the ongoing success of both individual businesses and the grazing industry. How the grazing sector deals with the side effects associated with grazing, e.g., adverse impacts on our environment and consumers' perception of animal welfare, is becoming increasingly important. Expectations of the industry to demonstrate its 'good corporate citizenship' will continue to grow over time.

These challenges must be addressed through an open, honest and informed debate that continually reviews practices at farm-level while building a better consumer understanding of the challenges and realities of farming and food production in the broader community. Unless the industry can collectively develop and engage an environmentally sustainable system of natural resource management reporting, the grazing industry can continue to expect externally developed regulation and negative narrative to undermine the grazing industry social license to operate.

In response to these concerns the Grazing Best Management Practices (Grazing BMP) Partnership of Fitzroy Basin Association, AgForce and the Department of Agriculture, Fisheries and Forestry, in conjunction with a panel of graziers, designed a set of sustainable production standards that can clearly demonstrate equitable, sustainable production and enhanced environmental and animal welfare outcomes to the broader community. Unlike past attempts to develop best management practices for the grazing industry by a host of stakeholders, the Grazing BMP program has been developed from the 'bottom up' by graziers- for graziers.

The Grazing BMP Partnership wants to contribute to developing a grazing industry that is environmentally and economically sustainable and has broad public support. Thus, Grazing BMP is an industry lead and owned tool that aims to respond to these growing concerns with real, current data developed and ratified by independent industry professionals that ensure progression and development of the industry is focusing on delivering real on ground benefits to all stakeholders.

Application of remote sensing for mapping and monitoring rangeland condition

Dan Tindall^A, Peter Scarth^B, John Carter^C, Rebecca Trevithick^D, John Armston^E, Christian Witte^F, Neil Flood^G, Robert Denham^H, Fiona Watson^I, Stuart Phinn^J, Tim Danaher^K, Tony Gill^L, Richard Lucas^M, Jason Barnettson^N and Grant Staben^O

^ARemote Sensing Centre, Department of Science Information Technology and Innovation, GPO Box 5078, Brisbane QLD 4001. E: dan.tindall@dsitia.qld.gov.au. Ph: 07 3170 5688.

^BJoint Remote Sensing Research Program. Biophysical Remote Sensing Group, School of Geography, Planning and Environmental Management, The University of Queensland, Brisbane, QLD 4072. E: p.scarth@uq.edu.au, Ph: 07 3170 5678

^CRemote Sensing Centre, Department of Science Information Technology and Innovation, GPO Box 5078, Brisbane QLD 4001. E: john.carter@dsitia.qld.gov.au, Ph: 07 3170 5507

^DRemote Sensing Centre, Department of Science Information Technology and Innovation, GPO Box 5078, Brisbane QLD 4001. E: rebecca.trevithick@dsitia.qld.gov.au, Ph: 07 3170 5679

^ERemote Sensing Centre, Department of Science Information Technology and Innovation, GPO Box 5078, Brisbane QLD 4001. E: john.armston@dsitia.qld.gov.au, Ph: 07 3170 5665

^FRemote Sensing Centre, Department of Science Information Technology and Innovation, GPO Box 5078, Brisbane QLD 4001. E: christian.witte@dsitia.qld.gov.au, Ph: 07 3170 5649

^GJoint Remote Sensing Research Program. Biophysical Remote Sensing Group, School of Geography, Planning and Environmental Management, The University of Queensland, Brisbane, QLD 4072. E: neil.flood@dsitia.qld.gov.au, Ph: 07 3170 5677

^HRemote Sensing Centre, Department of Science Information Technology and Innovation, GPO Box 5078, Brisbane QLD 4001. E: robert.denham@dsitia.qld.gov.au, Ph: 07 3170 5676

^IRemote Sensing Centre, Department of Science Information Technology and Innovation, GPO Box 5078, Brisbane QLD 4001. E: fiona.watson@dsitia.qld.gov.au, Ph: 07 3170 5670

^JJoint Remote Sensing Research Program. Biophysical Remote Sensing Group, School of Geography, Planning and Environmental Management, The University of Queensland, Brisbane, QLD 4072. E: s.phinn@uq.edu.au, Ph: 07 33656526

^KNative Vegetation Science Branch, Science Division, NSW Office of Environment and Heritage, PO BOX 856, Alstonville, NSW, 2477. E: Tim.Danaher@environment.nsw.gov.au, Ph: 02 6627 0224

^LNative Vegetation Science Branch, Science Division, NSW Office of Environment and Heritage, PO BOX 1020, Dubbo, NSW, 2830. E: Tony.Gill@environment.nsw.gov.au, Ph: 02 6841 0914.

^MSchool of Biological, Earth and Environmental Sciences, University of NSW, Kensington, NSW. Ph: 02 9385 0356

^NRangeland Monitoring. NT Department of Land Resource Management, PO Box 1120, Alice Springs, NT 0871. E: Jason.Barnetson@nt.gov.au, Ph: 08 8951 9259

^ORangeland Monitoring. NT Department of Land Resource Management, PO Box 496, Palmerston, NT 0831. E: Grant.Staben@nt.gov.au, Ph: 08 8999 4809

continued page 60

Application of remote sensing for mapping and monitoring rangeland condition

continued from 59

KEYWORDS: remote sensing, modelling, mapping, land condition

Since 2007, state agencies on the east coast of Australia and the University of Queensland have been collaborating through the Joint Remote Sensing Research Program (JRSRP). This has resulted in a significant acceleration in the development and successful operational application of remote sensing methods for the JRSRP members and the various state and national programs and policies which they support. More recently this collaboration has included the Northern Territory's Department of Land Resource Management with a focus on rangeland monitoring. The JRSRP provides an open and collaborative mechanism and governance structure to successfully bring together a unique combination of expertise in image processing, field data collection, and data integration approaches to deliver accurate, repeatable and robust methods for mapping and monitoring Australia's unique ecosystems.

Remote sensing provides spatially- and temporally-comprehensive information about land cover features at a range of scales and often for minimal cost compared to traditional mapping and monitoring approaches. This makes remote sensing a very useful operational mapping and monitoring tool for land managers, particularly in the vast rangelands of Australia. This poster presentation outlines the current remote sensing and modelling products which are being used operationally by JRSRP members and collaborators for monitoring past, present and future changes in land condition, informed by extensive field-based baseline measures. Ongoing research and development is underway to integrate the remote sensing and modelling products to improve indicators of land condition state and change and to identify and target potential land condition issues in near real time.

Cattle grazing found to have had no negative effect on soil carbon stocks at a site in the Northern Territory

Dionne Walsh and Peter Shotton

NT Department of Primary Industry & Fisheries,
GPO Box 3000, Darwin NT 0801.

E: dionne.walsh@nt.gov.au, Ph: 08 8999 2178,

E: peter.shotton@nt.gov.au, Ph: 08 8978 2442

KEYWORDS: carbon farming, Barkly tableland, grazing intensity, cattle, water point, vertosol

Soil organic carbon (SOC) stocks were measured at three water points in the same paddock on the Barkly Tableland in 2013. The water points were selected based on age - the oldest was established in 1910, the second oldest in 2005 and the youngest in 2010. The study aimed to determine what levels of SOC were typical for the cracking black soils (vertosols) in the paddock and whether there were any relationships between SOC stock, age of the water point and distance from water. The results confirmed previous work that showed that SOC is naturally quite low in the vertosols of the Barkly. There were very few statistically significant differences found between SOC stocks and age of the water point or distance from water. A notable exception was significantly higher SOC stocks at 100 m from the oldest bore, which could be due to the long-term accumulation of cattle dung and/or high turnover of short-lived plants. Soils from long-term ungrazed enclosures at the bores did not have significantly more SOC than adjacent heavily grazed areas suggesting that up to 100 years of grazing has had no discernible negative impact on SOC stocks at the study site. If typical, the results suggest that the economic potential for increasing SOC and earning carbon credits from the management of land condition on black soils in the Barkly region is low.

Palatable forbs less prolific than presumed on a black soil site in the Victoria River District

Jodie Ward^A and Dionne Walsh^B

^ANT Department of Primary Industry and Fisheries,
PO Box 1346, Katherine, NT 0861. Email: jodie.ward@nt.gov.au

^BNT Department of Primary Industry and Fisheries,
PO Box 3000, Darwin, NT 0801

KEYWORDS: pasture composition, 3P grasses, land condition, cattle grazing

Overgrazing around water sources has long been a problem for resource management, and therefore productivity, on cattle stations in northern Australia. This paper presents observations from a demonstration project investigating whether early wet season burning, followed by wet season spelling, every three or four years can rejuvenate a degraded pasture quicker than wet season spelling alone. The demonstration arose as a result of anecdotal evidence that the property manager had had success with early wet season burning and spelling for improving pasture quality and land condition.

BOTANAL surveys have been conducted annually since 2011 measuring pasture yield, species composition, ground cover and defoliation. Early analysis has focussed on species composition at the site and has found that forbs contribute significantly to the yield. However, the majority of the forb species recorded on the site are not considered to be palatable to cattle. Forbs are generally highly regarded by producers as they are usually higher in nutrition than many native grasses. However, when less palatable forbs are dominant, they do not contribute significantly to intake, which can result in lower than expected weight gain over the wet season. The findings highlight the importance of species knowledge and identification skills for land managers. This project is ongoing and will continue to investigate this and other pasture composition trends as the burning and spelling treatments are applied in the coming years.

Developing a regional incentive for retaining rangeland ground cover

C. M. Waters^{AF}, R. B. Hacker^B, K. Sinclair^C, A. Curtis^D, R. Lines-Kelly^C, Y. Alemseged^A and J. Leys^E

^ANew South Wales Department of Primary Industries,
PMB 19, Trangie NSW 2823

^BFormerly New South Wales Department of Primary Industries,
PMB 19, Trangie NSW 2823; current address Tenambit, NSW 2323

^CNew South Wales Department of Primary Industries,
1243 Bruxner Highway, Wollongbar NSW 2477

^DCharles Sturt University, Graham Centre for Agricultural Innovation,
Wagga Wagga, NSW 2650

^ENSW Office of Environment and Heritage,
PO Box 20, 9127 Kamilaroi Highway, Gunnedah, NSW 2380

^FCorresponding author. E: cathy.waters@dpi.nsw.gov.au

KEYWORDS: ground cover, market-based instrument

The management of ground cover is central for sustainable pastoral production in the Australian rangelands. Where changes in management achieve an increase in ground cover above the expected, then enterprise income may be reduced in the short-term. Under this scenario there is a trade-off between the natural resource benefit (public benefit), against forgone income through sacrificed feed-base (private cost). This trade-off provides a basis for considering public funding for private landholders to maintain ground cover above the expected. Performance-based incentive schemes that maintain above expected ground cover may provide potential benefits to landholder participants and the broader public through reduced soil erosion and drought mitigation and recovery. To date, no performance-based rangeland scheme has been implemented in Australia at a regional scale. We provide background to a new initiative to design a regional performance-based incentive scheme to manage ground cover in the rangelands of western New South Wales.

The influence of managing grazing intensity on soil organic carbon and biodiversity

C. M. Waters^{AF}, G. Melville^A, Y. Alemseged^A, S. E. Orgill^B, P. Gillespie^C, C. Bloomfield^C, M. Fleming^D, A. Kerle^E, W. Smith^A and, I. Toole^A

^ANew South Wales Department of Primary Industries,
PMB 19, Trangie NSW 2823

^BNew South Wales Department of Primary Industries,
Pine Gully Road, Wagga Wagga, NSW 2650

^CNew South Wales Department of Primary Industries,
Locked Bag 6006, Orange NSW 2800

^DNSW Office of Environment and Heritage,
PO Box 1967, Hurstville BC NSW 1481

^EKerle Environmental, 5 Fitzroy Street, Peel NSW 2795

^FCorresponding author. E: cathy.waters@dpi.nsw.gov.au

Total grazing pressure (TGP) management is advocated to increase ground cover but few rangeland studies have provided direct evidence of the relationship between management and natural resource. Using four paired paddock contrasts in semi-arid western NSW, the effects of different grazing management regimes with/without TGP fencing on total organic carbon (TOC), ground cover and biodiversity (floristic, bird, reptiles and invertebrates) were examined. Using a 200m sampling grid, soils samples were collected from the same vegetation/soil type (land unit) at four depths (0-5; 5-10; 10-20; 20-30cm). At each of 398 soil sampling sites two (0.25m²) quadrats were used to determine percentage ground cover and floristic diversity. The presence and proximity of each sample site to a shrub and/or tree base was also recorded. For each contrast, faunal diversity (birds, reptiles and bats) was measured using eight plots (200 x 100m). For each plot, two 50m transects, each with ten glycol pitfall traps were used to determine invertebrate diversity. Significantly higher ($P<0.01$) levels of TOC were found in paddocks managed using TGP + rotational grazing with more than 0.2% higher TOC at the soil surface (0.5cm). While the magnitude of these differences varied between land units, these differences were consistently associated with higher ground cover (perennial or litter) and higher floristic diversity. Total organic carbon levels were always significantly higher ($P<0.001$) when sample sites were in close proximity to trees. Holistic grazing management + no-TGP resulted in significantly ($P<0.001$) higher perennial ground cover and dung ($P<0.01$) which appears to be associated with higher levels of beetle diversity. Average species richness (area weighted) and uniqueness of each paddock contrasts are also reported. We provide evidence for the co-benefits (TOC, ground cover and biodiversity) associated with managing both the total grazing pressure and incorporating strategic periods of pasture rest.

Impacts of pasture spelling on the performance of a beef grazing property in northern Australia

Giselle Whish^A, Lester Pahl^A and Steven Bray^B

^AQueensland Department of Agriculture, Fisheries and Forestry,
Toowoomba, Qld. 4350. E: giselle.whish@daff.qld.gov.au

^BQueensland Department of Agriculture, Fisheries and Forestry,
Rockhampton, Qld. 4701

KEYWORDS: case-study property, simulated spelling strategies, land condition, animal productivity, property profitability

Northern Australian beef businesses face productivity, profitability and environmental pressures. Declining land condition reduces carrying capacity, livestock productivity and profitability. Pasture spelling can improve poor condition land by increasing the health and resilience of desirable 3P (perennial, palatable, productive) tussock grasses. For regeneration of pastures, spelling is most effective over the wet season when the grasses are actively growing and setting seed.

Bio-economic modelling was used to compare the performance of several rotational pasture spelling strategies on a case-study beef grazing property in central Queensland. The effectiveness of these strategies to improve land condition, animal productivity and enterprise profitability was assessed. A four-paddock rotational system, where each paddock was sequentially spelled once every four years for six months over the growing season (Dec-May), was modelled. Spelling strategies varied in how cattle from the spelled paddocks were distributed across the property, and in the stocking rates of the paddocks within the spell system. Strategies were analysed over 20 years.

The effectiveness of pasture spelling was influenced by the stocking rate, timing of spells, interaction with regrowth management practices, and the proportion of the herd affected. Spelling pastures with a reduced stocking rate improved pasture condition and live-weight gains. Both pasture condition and animal productivity declined in three of the five better condition paddocks when cattle from spelled paddocks were added for four or more consecutive growing seasons.

The impact of spelling scenarios had a relatively small effect on the overall herd productivity and profitability (less than 5% on total gross margin). Even so, the spelling scenarios that distributed extra animals within the system achieved the highest \$GM/AE. Pasture spelling can improve land condition, animal productivity and profit per beast but decisions regarding what to do with cattle from the spelled paddocks are critical to the success of strategies.

Stocktake Plus App optimises Grazing Best Management Practices (BMP) for managing grazing pressure

Megan R Willis

Department of Agriculture, Fisheries and Forestry,
1-5 Prior St Charters Towers, Queensland, 4820.
E: megan.willis@daff.qld.gov.au, Ph: 07 4761 5192

KEYWORDS: Stocktake Plus, forage budget, grazing, stocking rates, best management practice, industry standard

The Stocktake Plus App is an easy to use application available on Apple and Android devices. It can be used to monitor land condition and calculate forage budgets out in the paddock without mobile or internet reception. Adjusting stock numbers with the assistance of a forage budget allows a grazier to predict the need to reduce stock numbers or implement other strategies to maintain livestock and land condition. Forage budgets have been undertaken on Spyglass Research Station to demonstrate the practical application of the App on a commercial size property. The generated reports can be used to manage grazing pressure within each paddock through the dry season.

Adjusting stocking rates to meet current feed supply, animal requirements, and ground cover targets is considered best management practice within the grazing business. Best management practice in the grazing industry is about implementing practices that are most effective at achieving a productive, profitable and sustainable grazing business. The Grazing BMP program is an online self-assessment tool delivered in the Burdekin, Fitzroy and Mary-Burnett Catchments with the intent to expand state-wide. The self-assessment allows beef producers to assess their management practices against recommended industry standards, thus identifying strengths, weaknesses, opportunities, and threats; develop plans for improved practices within their whole business; and provide valuable regional data to support the grazing industry.

An analysis of the data collected in the Burdekin and Fitzroy Catchments from July 2013 to June 2014 demonstrates that over 70% of the businesses that have completed the Grazing Land Management module of Grazing BMP were at industry standard. By introducing the Stocktake Plus App as a management tool all of these businesses could exceed industry standard for the key area called Managing Grazing Pressure.

Ecosystem Management Understanding (EMU™), a landscape approach to rangeland management

Kenneth Wright^A and Hugh Pringle^B

^ADepartment of Environment, Water and Natural Resources,
Level 1, 9 Mackay Street, Port Augusta SA 5700.
E: ken.wright@sa.gov.au, M: 0417332400

^BPringle Environmental Services,
Alice Springs, NT 0870.
E: hpringle1@bigpond.com, M: 0418415269

KEYWORDS: partnership, ecosystem, landscape, skills, confidentiality

Ecosystem Management Understanding (EMU)™ is a landscape restoration process which works as partnership between the land manager and the EMU™ facilitators combining local knowledge with scientific expertise. Pastoralists in the South Australian Arid Lands Natural Resource Management Region have embraced this process. There are thirty properties currently participating, totalling over 3058 square kilometres in whole of property planning processes. The process has built the skills of the pastoralists, contractors and road builders to ensure that the rangelands are moving more towards restoration rather than further degradation. Land managers who have travelled the EMU™ path have often changed their focus from their most dysfunctional damaged country to strategically targeting areas within their most productive healthy country. The information provided by the pastoralist is treated as confidential, remaining the property of the pastoralist and not disseminated by government without the express permission of the pastoralist.

Rangeland Journal Lecture: Challenges for sustainable water management in the rangelands

Professor Stuart E. Bunn,
Director, Australian Rivers Institute, Griffith University,
Nathan, Queensland, 4111. E: s.bunn@griffith.edu.au

Balancing the water needs for humans and nature is a pressing global challenge. It is particularly difficult in landscapes where water is scarce, and especially so where inter-annual variability in rainfall is high. It becomes an imposing challenge when the monitoring network is sparse, the data record is short, and the climate is changing. Average statistics have little meaning in water plans and seemingly modest proposals for consumptive use can equate to all of the available water in some years. Low flows, timing of cease-to-flow and dry spell duration are critical hydrological variables from an environmental and cultural perspective. They dictate how often important surface water refugia persist in the landscape and how often they will be connected by surface flows. Unfortunately, the models and gauging network that underpin water planning were designed to estimate water yield, and poorly represent low flows. To compound matters, groundwater-surface water interactions in many systems are poorly understood. At the other end of the flow spectrum, many rivers in the rangelands are characterised by infrequent flood events that inundate vast floodplains and their associated wetlands. These generate a boom of production that sustains populations of fish and water birds, stimulate pasture production, and are a key driver of the structure and composition of floodplain vegetation.

The future of freshwater systems in the rangelands and the ecosystems and livelihoods they sustain is significantly threatened by changes at both ends of the flow spectrum. Managing the consequences of extended dry-spells from water extraction or climate change will require a more explicit spatial focus: where are surface water refugia; how many need to be protected and which ones; and how often do they need to be connected? The intensification of mining and the unconventional gas industry brings additional challenges, particularly in predicting the cumulative effects on groundwater aquifers and their dependent surface water systems, as well as from the disposal of co-produced water. Interception and harvesting of large flow events for intensive agriculture is proposed in some systems, and has the potential to diminish the duration and extent of floods and their associated ecosystem services. Poorly designed road networks and culverts on floodplain crossings and levees to protect mining or gas infrastructure, can also influence flood inundation patterns. My aim in this presentation is not simply to draw attention to the significant challenges of water resource management in the rangelands, but also to explore opportunities and solutions, and identify critical information needs to support these.

Managing the cumulative impacts from CSG water extraction in the Surat Basin, Queensland

Randall Cox, Pandey Sanjeev, Linda Foster and Steven Flook

Office of Groundwater Impact Assessment,
Department of Natural Resources and Mines,
PO Box 15216, City East QLD 4002.
E: steven.flook@dnrm.qld.gov.au, Ph: 07 3199 7310

KEYWORDS: coal seam gas, Surat Basin, Great Artesian Basin, groundwater impact assessment

In Queensland, the coal seam gas (CSG) industry continues to expand in the Surat and Bowen basins. CSG production involves pumping water from the coal seams to release the gas adsorbed to coal particles. The reduction in water pressure in the coal seams will cause a reduction in water pressure in overlying and underlying aquifers to some degree, as there is always some interconnectivity between formations.

The Surat Basin is a sub-basin of the Great Artesian Basin which contains aquifers of high economic, environmental and cultural value. The paper describes the role of the Office of Groundwater Impact Assessment (OGIA) in managing the impacts of CSG water extraction on groundwater resources, within the broader regulatory framework.

The Queensland regulatory framework has a general requirement for petroleum tenure holders to make good any impairment of water supply from private water bores affected by CSG water extraction, and to collect baseline data from water supply bores before production commences. Petroleum tenure holders are also required to: assess potential impacts of planned water extraction on aquifers; establish groundwater monitoring programs; and establish spring monitoring programs.

In areas of intensive development the impacts of groundwater extraction from individual CSG projects can overlap and a cumulative approach is required for assessment and management.

Such areas can be declared a 'Cumulative Management Area'. When such an area is declared the OGIA becomes responsible for preparing and periodically updating an Underground Water Impact Report (UWIR) which contains: a cumulative assessment of water level impacts; a regional groundwater monitoring strategy; a regional spring impact management strategy; and rules for the assignment of management responsibilities to individual petroleum tenure holders within the area.

The first Surat UWIR was approved in December 2012. OGIA is now supporting tenure holders in the implementation of the management responsibilities established under the report and developing new knowledge in relation to geology, interconnectivity and springs, to support the updating of the Surat UWIR in late 2015.

Understanding environmental condition for the strategic adaptive management of Lake Eyre Basin waterways

Dale G. McNeil and David W. Schmarr

Goyder Institute for Water Science,
South Australian Research and Development Institute (Aquatic Sciences).
2 Hamra Ave West Beach, SA, 5024.
E: dale.mcneil@sa.gov.au, Ph: 08 820 75342.
E: david.schmarr@sa.gov.au, Ph: 08 8207 5377

KEYWORDS: Lake Eyre Basin, condition assessment, aquatic ecology, natural resource management, fish, climate

Assessing and monitoring environmental condition is an important aspect of understanding how human pressures are impacting on aquatic ecosystems, and predicting, measuring and circumventing future changes that may stem from human developments. In the Lake Eyre Basin, understanding condition has a number of unique characteristics that make it hard to apply condition assessment methodologies developed for other river Basins.

Firstly, the current impacts of human development are relatively low when compared to the vast majority of the world's river systems. This makes it crucial that we can predict what kinds of impacts can be expected from future development and how these impacts may show themselves in the early stages, before catastrophic change impacts the resilience of the system.

Secondly, the system is so variable and climatic and hydrological conditions so harsh, that even in its natural state, the condition of some areas is going to appear extremely poor compared to natural sites in more predictable and benign habitats such as perennial waterways in temperate regions (for which most condition assessments have been developed).

Finally, there is relatively little data to tell us exactly what the current state of the Basin is with a small number of assessment and research projects collecting discontinuous and spatially disparate data.

This paper presents a body of research being conducted by the Goyder Institute for Water Research that aims to bring together knowledge and data for the Basin to develop our scientific understanding of how the Basin's Rivers work and what aspects of the system best represent or herald likely changes in future environmental condition. Based on this work, the project aims to explore options for building a tailored condition assessment methodology that will support the future management of the Basin's waterways and aquatic biota.

Non, je ne regrette rien: what do four years of LEBRA monitoring tell us?

David W. Schmarr^A, Dale G. McNeil^A, Angus Duguid^B and Bernie Cockayne^C

^AGoyder Institute for Water Science,
South Australian Research and Development Institute (Aquatic Sciences).
2 Hamra Ave West Beach, SA, 5024.
E: david.schmarr@sa.gov.au, Ph: 08 8207 5377,
E: dale.mcneil@sa.gov.au, Ph: 08 820 75342

^BNT Government Department of Land Resource Management,
PO Box 1120, Alice Springs, NT 0871.
E: angus.duguid@nt.gov.au, Ph: 08 89519264.

^CDepartment of Natural Resources and Mines,
PO Box 63, Mackay Qld, 4740
E: Bernie.Cockayne@dnrm.qld.gov.au, Ph: 07 4999 6840

KEYWORDS: fish, occupancy modelling, monitoring, Lake Eyre Basin, aquatic ecology, hydrology, water quality

The Lake Eyre Basin Rivers Assessment (LEBRA) is a multi-agency monitoring program designed to monitor and assess the condition of watercourses and catchments in the Lake Eyre Basin (LEB), their related natural resources, and those factors likely to affect them such as water resource development and land use change. After several years of planning, deliberation and setbacks, four years ago we began collecting data for LEBRA on a “no regrets” basis.

The program has succeeded in establishing a network monitoring fish, water quality and hydrology at more than 45 sites covering all of the major catchments in the basin targeting key refuge habitats, which are of critical significance in supporting reach, catchment and basin scale processes.

Monitoring data from these first four years has provided an insight into the range of variability inherent in this system. Changes in the distribution and abundance of fish species in response to changes in flow and water quality has provided an ideal opportunity to empirically test the conceptual models developed for this system as part of the Goyder LEB project.

We will present the results of model analyses that estimate the probability of fish species' occupancy of waterholes in the basin and examine which environmental variables affected occupancy. This approach allows the relative importance of environmental factors for each species to be related to their ecological traits. In turn, we will gain a greater understanding of the primary controls of fish distribution in the LEB.

Our findings combined with ongoing LEBRA monitoring will continue to improve our understanding of the Basin's rivers and catchments, our ability to determine if the condition of the Basin is shifting beyond what we would normally expect, and the scientific integrity behind management decisions.

One river - many journeys: fish and drought refuges in the Finke

Angus Duguid^A, David Schmarr^B, Rupert Mathwin^B, Pat Hodgens^C, David Cheshire^B, Dale McNeil^B, Jed Macdonald^D, Michael Hammer^E and Simon Townsend^F

^ANT Government Department of Land Resource Management,
PO Box 1120, Alice Springs, NT 0871. E: angus.duguid@nt.gov.au, Ph: 08 8951 9264

^BSARDI Aquatic Sciences (Government of South Australia),
PO Box 120 Henley Beach SA 5022.
E: david.schmarr@sa.gov.au, Ph: 08 8207 5377; E: rupert.mathwin@sa.gov.au, Ph: 08 8207 5385;
E: david.cheshire@sa.gov.au, Ph: 08 8207 5384; E: dale.mcneil@sa.gov.au, Ph: 08 8207 5342

^C2 Wallis St, Alice Springs, NT 0870. E: pathodgens@yahoo.com.au, M: 0406 033 568

^DFaculty of Life and Environmental Sciences, University of Iceland,
Sturlugata 7, 101 Reykjavík, Iceland. E: jedimacdonald@gmail.com

^EMuseum and Art Gallery of the Northern Territory,
GPO Box 4646 NT 0801. E: michael.hammer@nt.gov.au, Ph: 08 8999 8253

^FNT Government Department of Land Resource Management,
PO Box 496, Palmerston, NT 0831. E: simon.townsend@nt.gov.au, Ph: 08 8999 3413

KEYWORDS: water, river, arid-zone, ecosystem, fish, refuge

The Finke is often touted as the oldest river on earth. The veracity of this is hard to quantify, as are statements about the Finke's significant biodiversity. Until recently, limited biological data was virtually all from the rocky headwaters and there had been no systematic population surveys of fish. This was a glaring knowledge gap, given that the fish species diversity is among the highest for strictly arid zone Australian rivers. This diversity has been attributed to the abundance of drought refuge waterholes, yet there was inadequate documentation of waterhole location and persistence. Now four years of effort has lifted the veil on the refuge ecology of the Finke fishes, using an innovative combination of methods. The cornerstone has been the Lake Eyre Basin Rivers Assessment (LEBRA) which applies consistent methods across the Basin in monitoring fish, hydrology and water chemistry. This is an unusual interstate collaboration of multiple jurisdictions. In the Finke catchment, the NT Government has supplemented LEBRA with several other projects involving many partners and diverse funding sources. This has substantially improved capacity to determine environmental requirements of future economic activities such as fossil fuel resource development. Previously undocumented drought refuges have been surveyed in areas of the catchment where science was previously blind. Local knowledge and Aboriginal participation have been key ingredients. Understanding of drought refuge function has blossomed, with groundwater and natural salinity now regarded as critical drivers. However, LEBRA monitoring has not yet achieved an adequate baseline for fish dynamics. We are yet to establish the drivers for changes in assemblage and abundance at some monitoring sites, and are yet to document repeating patterns in response to major wet/dry phases. Chaotic and hard to predict population dynamics may be a natural feature of the system but we will only find out through longer-term monitoring.

Reading the signs: Arabana, water and country

Melissa Nursey-Bray

University of Adelaide.

E: Melissa.Nursey-Bray@adelaide.edu.au,

M: 0 437 738 635

KEYWORDS: cultural indicators, Australia, water, Arabana, indigenous

Water is of paramount importance to all people that live in regions such as the Kathi Thanda Lake Eyre, Australia but to Indigenous people such as the Arabana, it also holds immense cultural significance. Having lived in the region for thousands of years, Arabana people have worked out how to assess the ecological condition of their water sites in particular ways. This paper presents the results of a collaborative project designed to develop a suite of cultural indicators for water in the Kathi Thanda region. Based on field trips, and a comprehensive desk top review, we present the 'signs' used by Arabana to assess condition, and discuss whether or not these can be used in more generic ways across the region to assist in broader river assessment processes. We conclude with some reflections on how the development of these indicators can be integrated with Western indicators in ongoing management.

(Student). Degraded or just dusty? Examining 150 years of ecological change in inland eastern Australia

J.L. Silcock^{AB} and R.J. Fensham^{AC}

^AThe Ecology Centre, School of Biological Sciences, University of Queensland, St Lucia, 4072, Queensland (PhD candidate; thesis submitted September 2014)

^BSustainable Agriculture Flagship, CSIRO Ecosystem Sciences, Boggo Road, Dutton Park., 4012, Queensland. E: jennifer.silcock@uqconnect.edu.au

^CQueensland Herbarium, Department of Environment and Resource Management, Brisbane Botanic Gardens, Mt Coot-tha Road, Toowong, 4066, Queensland, Australia

KEYWORDS: degradation, explorers, grazing, vegetation change, rare species

The ecological history of rangelands is often presented as a tale of devastation, where fragile drylands are irreversibly degraded through inappropriate land-use. There is confusion about how to recognise and measure degradation, especially in low productivity environments characterised by extreme natural variability and where abrupt management upheavals mean that there are few reference sites. These issues have important consequences for rangeland development and management programs, many of which are founded on a perception of serious and ongoing degradation from a former 'natural' state. We employ three approaches to assess degradation in inland eastern Australia, part of one of the largest desert landforms in the world and subject to recurring arguments about the cause and magnitude of landscape change since pastoral settlement 150 years ago: explorer journals dating from the 1840s, grazing exclosures across four widespread land types, and identification and surveys of rare and potentially sensitive elements of the flora.

We found no evidence of unidirectional change in vegetation structure, irreversible degradation of plant communities or loss of plant species, although some palatable species have declined at a landscape scale. With the exception of 12 artesian spring species, continuing declines were documented for just six plant species, while large (>1000 plants), healthy and regenerating populations of 62 of 91 species (68%) identified as rare and/or threatened were found. It is apparent that some prevailing paradigms have become entrenched despite lack of empirical evidence. However, many medium-sized mammals have declined dramatically or become extinct since European settlement, while large macropod numbers have increased dramatically in the semi-arid zone. Multidisciplinary regional studies combining historical sources, measurement of sites with different management histories and targeted surveys for sensitive and rare elements of the flora and fauna can facilitate critical assessments of ecological change in regions subject to abrupt management upheavals and with contentious ecological narratives.

Aboriginal people choose new media for an old practice

Fiona Walsh^A, Gareth Catt^B and Dave Wells^C

^ACSIRO Land & Water Flagship,
PO Box 2111, Alice Springs NT 0870.
E: Fiona.Walsh@csiro.au

^BKanyirninpa Jukurrpa,
PO Box 504, Newman, WA, 6753

^CPrevailing Wind Productions,
www.prevailingwind.com.au

KEYWORDS: fire management; indigenous knowledge; video production; Aboriginal rangers

We report on a project about fire management and indigenous knowledge sharing. The Western Desert fire program considered two key questions - How to reduce wildfire regimes that are extreme and intensifying in desert landscapes? And how to facilitate the intergenerational transfer of Aboriginal ecological knowledge about fire management practice?

Unexpectedly, Aboriginal rangers preferentially chose a video production rather than other media to share knowledge about fire. There were important reasons for their choice. We found Martu people actively engaged in video making as it had direct relevance to their skills, topic of interest, and an applied context. They shaped the video content to reflect their contemporary reality of integrated knowledge rather than exclusively 'traditional' knowledge.

Partly as a consequence of their choice, the project evolved from an original objective to 'share traditional knowledge' to reflect more dynamic intercultural contemporary realities. Through film, traditional knowledge was both regenerated and integrated with other knowledge sources. Increasingly video is used to record and share indigenous ecological knowledge. Traditional knowledge can be revitalized in a topical context amongst people active in fire management on country. Video is likely to have social impact and improve practice when and where there are situated, timely and social contexts. Video complements but does not replace lifelong experience and learning about the subtleties of burning – or not burning.

Western Arrarnta Seasonal Chart

Else Kennedy, Christopher Brocklebank and Mark Inkamala

Italk library, 2 Mueller st Alice Springs 0870.

E: Else.kennedy@gmail.com, M: 0404 135 975;

E: Christopher@italklibrary.com, M: 0408 899 121

KEYWORDS: seasons, plants, digital media, language and culture

Western Arrarnta Seasonal Chart

italk library, together with Western Arrarnta Media and Ntaria School are creating a digital Western Arrarnta Seasonal Chart. This chart is an interactive tool for the maintenance and revitalization of Western Arrarnta language and information related to the weather, seasons, and plants.

The Western Arrarnta Seasonal Chart supports communication of language and cultural information, to a younger generation educated through a modern Australian classroom. It brings the outside world inside the classroom.

Indigenous young people are increasingly familiar with iphone, ipad and android applications and make use of them in their everyday lives. The Western Arrarnta Seasonal Chart builds on the strengths of interactive digital devices.

italk library

italk library creates visual stories in various languages. All stories can be freely seen at www.italklibrary.com. italk library has developed an innovative software, italk™, through which users can generate their own stories in their own language, or swiftly record existing stories into a new language.

Italk library has two core aims:

- To make information accessible to everybody
- To creatively overcome the educational barriers of language and literacy

Through italklibrary, users can understand information:

- even if they have low levels of literacy or cannot read at all
- even if they do not speak English, as stories are spoken in their own first language.

italk library has made stories with government and non-government organisations covering topics including training, money, human rights, gambling, disability and mental health, with a growing list of stories and languages, including 14 Indigenous languages from across the Northern Territory. To date (October 2014), there have been over 50,000 viewings of italklibrary stories.

Building on the knowledge of the Aboriginal land managers of tomorrow

Meg Mooney

Tangentyere Council,
PO Box 8070, Alice Springs, NT 0871.
E: meg.mooney@tangentyere.org.au,
M: 0400 942 539

KEYWORDS: two-way science education, indigenous ecological knowledge,
two-way communication

Research has shown and Indigenous ranger groups and others have demonstrated that the combined use of Western science and Indigenous ecological knowledge increases engagement of Aboriginal people in contemporary land management.

For the last 16 years, Tangentyere's Land & Learning project has developed a program which is a vehicle for remote Indigenous community schools to teach this two-way science. The program engages students in science, and two-way literacy, by linking teaching to the local country, building on students' knowledge and interest in the bush.

Land & Learning, which has worked with 27 central Australian Indigenous community schools, supports transition to work in Indigenous rangers groups by providing students with relevant knowledge and skills and involving them in on-ground activities with local rangers.

The project involves local Indigenous communities in their schools, which research shows to be a major influence on educational outcomes for Aboriginal children. Land & Learning works with Indigenous Assistant Teachers and elders to develop and carry out Indigenous Language and Culture programs, linked to Western science, in schools. The project supports Assistant Teachers to teach Indigenous ecological knowledge, including Indigenous languages, in which students have far greater understanding.

Land & Learning provides on-ground support for planning with all school staff, and for bush and classroom activities. Unique resources produced by the project include an extensive booklet with information on central Australian ecology, two-way science activities and worksheets; a series of local plant and animal photo-cards in various Indigenous languages; and two-way booklets on project activities and local land management issues. These resources are also used by Indigenous ranger groups and others.

Science Pathways for Indigenous communities projects developed and carried out by Land & Learning for CSIRO Education have been used as a model for part of a national CSIRO/BHP Indigenous science education program launched recently.

Using eExtension to enable change in the rangelands

John James

FutureBeef eExtension Team Leader,
Department of Agriculture, Fisheries and Forestry (DAFF),
203 Tor Street, Toowoomba Qld 4350.
E: john.james@daff.qld.gov.au, Ph: 07 4688 1125

KEYWORDS: eExtension, change, adoption, webinar, YouTube, social media

eExtension is the use of electronic technologies, such as webinars and YouTube videos, to enhance face-to-face and paper-based interactions that enable change. Face-to-face interaction is the best way to build trust and rapport, and is especially important at technical workshops when the content is often complex and difficult to communicate easily. However, too often we wrap up the workshop and leave the participants to their own devices to implement the often complex concepts discussed during the workshop.

eExtension approaches allow us to continue the conversation with the attendees over an extended period of time without anyone needing to travel several hours to attend the event. This 'learning journey' approach allows participants to ask further questions as they trial the recommended approaches, and enables them to share their progress with other members of the group. This positive peer group pressure can encourage other members to adopt the innovations, so after 12 or 18 months there is a much higher level of adoption than if we treated the workshop as a 'flash in the pan' activity. The continued engagement can also lead to changes in the knowledge, skills and attitudes of workshop presenters. They may become aware of limitations of the innovation being promoted and different ways of applying it in the field. eExtension should be seen as a two-way mode of communication that complements your other extension activities.

This presentation covers a range of eExtension approaches that you can use as part of project communication activities, including webinars, YouTube videos and social media.

“Australian Outback: Heart of a Continent”

Alun Hoggett

Desert Channels Group,
135 Falcon St, Longreach Qld 4730.
E: alun@dcq.org.au, M: 0427 427969

KEYWORDS: documentary, outback, future, rangeland, film, geography

No documentary to date attempts to portray the diverse human and natural geography of the rangelands of Australia. At the end of 2013 Alun Hoggett, film maker with Desert Channels Group began research to develop a proposal for funding a documentary or series under the working title *Australian Outback: Heart of a Continent*. The intention of the documentary is to move Australians to a deep appreciation of the land that supports them, the people who manage and care for it, and the challenges they face. It is a story that will help dissolve many of the misconceptions that urban people have about the bush, and the people who make their living there. It aims to instil pride, not in some romantic notion of Outback, but in the whole of the living, changing, pulsing county at the heart of the Australian continent. The documentary will acknowledge the past, show the challenges of the present and reach into possible futures of this vast natural landscape. In the conference session Alun will show a 10 minute trailer to communicate the concept of the documentary. Following the trailer will be a facilitated discussion, and recording of themes and filmmaking approaches, drawing ideas from the conference attendees. This input from the conference will identify insights on the past, present and future management of the Rangelands, strengthening the foundation of research on which the documentary concept will be built

Communicating natural resource management projects in the rangelands of WA

Teresa Belcher

Rangelands NRM,
Suite 8, 125 Melville Parade, Como WA 6152.
E: teresab@rangelandswa.com.au,
Ph: 08 9468 8253, M: 0488 594 324

KEYWORDS: communication, remote, film, social media, competition, technology

Rangelands NRM WA is a not-for-profit, independent community-based organisation that works to coordinate projects throughout the rangelands of Western Australia that assist land managers to look after their natural resources, enhance land use and achieve good environmental outcomes. Our audience is diverse, ranging from pastoralists, Aboriginal groups, state government departments, community groups and the general public.

Communicating to people living in the remote outback of Western Australia has its challenges. Given their diversity, the message and approach is important. As technology improves, more individuals living in the rangelands of Western Australia have access to the Internet and the benefits of social media including Facebook and YouTube.

This presentation will showcase the different approaches and tools Rangelands NRM uses communicates about the work undertaken in our projects including in weed control, monitoring of endangered species, fire management, sustainable land management and feral animal control. Communication tools include a monthly eNews, short films, social media (Facebook, Twitter and Pinterest) and the School of the Air Photo Competition, run each year with children in remote schools.

Adventures with video – practical tips and tricks on sharing your story

Rod Campbell

Communications Team Leader, Central West Local Land Services.
E: rodney.campbell@lls.nsw.gov.au, Ph: 02 6881 3430

Technical and financial barriers to video are now gone. Never before have we been so well equipped to share our story on camera with our communities and the world.

While video gear, shooting techniques, production and sharing can be done to the nth degree, the world is very obliging if you keep it simple and have a story to tell.

Over the last three years Central West Local Land Services and its legacy agencies have begun using video and youtube to share news and stories.

While many mistakes were made, this biggest lesson from this body of work is to hit record and fine tune with experience. Providing relevant and useful information through video is not hard or expensive.

Even with a modest start up budget (or none), you can begin. Many digital cameras now record in broadcast quality. Smart phones are driving high level video content to captivated viewers.

With a cheap tripod, mobile phone and lapel mike, you can begin producing quality video and reaching people who will never sit in the same room as you.

Youtube and similar platforms make it easy to regularly upload and share material through your existing communications channels. A two minute video can be easily emailed, newslettered, facebooked and twittered.

With regional TV news under resourced, there is also golden opportunity to provide your content for broadcast. Become your own TV crew and take advantage of this issue affecting regional Australia.

How should you be judging your content? While 'viral' still remains hit and miss, you can observe how your audience is engaging with you and improve.

Begin today and get better. What are the rules? Relevant, interesting and timely is your starting point. Then keep it under two minutes with good lighting and audio. Share and do the next better.

The Rangelands Partnership: information to spur innovation in rangeland research, education and practice

Jodee Kuden^A, Jeanne Pfander^B and Barbara Hutchinson^C

^AUniversity of Alaska, Consortium Library.

E: jlkuden@uaa.alaska.edu, Ph: +1 907/786-1875

^BUniversity of Arizona, UA Libraries.

E: jpfander@email.arizona.edu, Ph: +1 520/621-6375

^CUniversity of Arizona, College of Agriculture and Life Sciences.

E: barbarah@cals.arizona.edu,

Ph: +1 520/626-0329.

KEYWORDS: web portals, information systems, knowledge sharing, rangeland management, international collaboration, resources and videos

The Rangelands Partnership actively collaborates with organizations in the U.S. and around the world to provide a variety of information and learning resources to the rangeland community. This innovative international collaboration brings together resources from the U.S., Australia, Canada, Mexico, FAO, and most recently South Africa. These resources integrate research, education, and Extension knowledge, and support the information needs of multiple audiences. A database of more than 14,000 full-text articles, conference proceedings, reports, videos, maps, and websites includes research results relevant for scientists, professionals, land managers, and students. Included in the database are the back files of Society for Range Management (SRM) journals, proceedings from the Australian Rangeland Society, and worldwide rangeland materials from the Food and Agriculture Organization of the United Nations (FAO). Moving to expand global content, the University of Hermosillo in Mexico is developing a "Sonora Rangelands" site. Searches can be customized to limit to specific topics, authors, geographic locations, and other attributes. Unique educational resources include special sections on "Careers and Education", "Online Courses" and "Teaching Tools." In addition, Extension/outreach resources for the broader public include a multimedia page with an extensive YouTube channel consisting of more than 70 videos on various rangeland topics. To inform audiences about current issues, the RangelandsWest.org website provides a collection of summaries and information resources on North American "hot topics" such as wolf reintroduction, grazing on public lands, and wild horses and burros. The Partnership also maintains a Facebook page, a Scoop.it news service, and a Twitter feed. The Rangelands Partnership members represent 19 Land-Grant universities in the United States, each of which maintains their own local state rangelands website focusing on the needs of their specific clientele, as well as association and international collaborators.

<http://globalrangelands.org/>

<http://globalrangelands.org/rangelandswest/>

<http://globalrangelands.org/arizona>

<https://www.facebook.com/RangelandsWest>

<https://www.youtube.com/user/GlobalRangelands>

<https://twitter.com/RangelandsPartn>

<http://www.scoop.it/t/rangelands>

Desert Poppies: connecting ladies in central Australia

Camilla Osborn

Centralian Land Management Association. E: clma@clma.com.au, Ph: 08 8953 4239

KEYWORDS: rural women, communication, communities, central Australia, ladies, Desert Poppies

In October 2013 the Centralian Land Management Association (CLMA) the Landcare group that supports pastoralists in central Australia organised a two day 'Influential Women' workshop to be run in Alice Springs. Nineteen women attended this workshop, mostly from local cattle stations plus some local extension staff. Attendees wanted to do something to better connect women across central Australia and Desert Poppies was born. The Desert Poppies network continues to grow and currently has over 70 women engaged. It is used to support and inform central Australian women of opportunities to connect with each other personally and professionally as well as hold events of its own.

At the time of writing, Desert Poppies is in full swing organising its next function, a ladies day. This day will be filled with practical workshops focussed on wellbeing and personal development in a casual atmosphere. These events provide often geographically isolated women to connect and communicate with each other as well as have fun. Our last two events had local ladies share their personal stories that both surprised and captivated their audience. We have also attracted some high profile speakers including Hon. Bess Price MLA – The NT Minister for Women's policy and Hon. Kezia Purick MLA – NT Speaker, who gives her ongoing support to the initiative. Outcomes have included a dynamic group of women who are meeting and connecting with each other to organise each event and opportunities for networking at the event are well used. Those that have had the public speaking opportunity have excelled. Desert Poppies offers child care during the event so children get the opportunity to mingle as well.

Adaptation as a trigger for transformation pathways in remote Indigenous communities

Yiheyis Taddele Maru^A, Digby Race^B, Ashley Sparrow^C and Supriya Mathew^D

^ACommonwealth Scientific and Industrial Research Organisation (CSIRO),
Alice Springs, NT, 0870. E: Yiheyis.Marud@csiro.au, Ph: 08 8950 7129

^BFenner School of Environment & Society,
ANU, Canberra, ACT. 0200. E: Digby.Race@anu.edu.au, M: 0419 638 406.
Formerly CRC-REP and CSIRO.

^CCSIRO,
Floreat, Perth, WA, 6014. E: Ashley.Sparrow@csiro.au, Ph: 08 8950 7129

^DCharles Darwin University,
Alice Springs, NT 0870. E: Supriya.Mathew@cdu.edu.au, M: 0449 977317

KEYWORDS: remote vulnerability, remote resilience, transformation, Indigenous, disadvantage

Indigenous people in remote Australia are recognised as some of the most vulnerable people to the impacts of climate change. Socio-economic disadvantage has been identified as a major underlying cause for their heightened vulnerability. Adaptation to climate change in remote Australia will only be successful for Indigenous communities if it simultaneously addresses the root causes of their vulnerability and builds on their adaptive capacity.

While external structural factors (e.g. remoteness, historical marginalisation, and lack of effective governance) are commonly raised as root causes of disadvantage, internal behavioural factors (e.g. welfare mentality and a lack of motivation to work) are sometimes argued to be the predominant reasons for current dire conditions. Different assumptions about the causes of disadvantage have led to different strategies for Indigenous engagement, service delivery and closing the socio-economic gap with mainstream Australia.

From a systems perspective, either a structural or a behavioural approach in isolation is likely to provide only a partial explanation. We argue that both structural and behavioural factors together are more likely to form a reinforcing relationship that creates a vulnerability 'trap' from which is hard for people to escape. Furthermore, an excessive focus on peoples' vulnerability can be at the expense of also understanding elements of resilience to climate and other changes. Addressing such vulnerability traps will require transformation pathways that build and expand on existing resilience elements.

In this paper, we present a systems-based approach to assessing opportunities for climate resilient transformation pathways in remote Australia. We draw upon recent research in central Australia to explore the dimensions of a vulnerability 'trap' to impacts of climate change and extremes. We then introduce a Vulnerability-Resilience for Transformation (VR4T) framework that simultaneously acknowledges vulnerability and resilience, and thereby provides a strength-based and innovative approach for identifying strategies for desirable, and potentially transformational, change.

Climate change perceptions and adaptive strategies: reflections from two remote Aboriginal communities

Matthew Campbell^A, Digby Race^B, Karl Hampton^{BC}, Denise Foster^A, Clara Fejo^C and David Robertson^C

^ATangentyere Council,
Alice Springs, NT, 0870.
E: matthew.campbell@tangentyere.org.au

^BFenner School of Environment & Society,
ANU, Canberra, ACT. 0200.
E: Digby.Race@anu.edu.au,
M: 0419 638 406. Formerly CRC-REP and CSIRO.

^CNinti One Ltd, Alice Springs, NT, 0870.

KEYWORDS: climate change, central Australia, adaptive capacity, liveability

Immense social changes brought about by the influx of Europeans to central Australia have forced Aboriginal people to adapt to changing social and environmental circumstances over the past 150 years ago. Adaptation would have been a central feature of their lives, given the enormous variability in the region's climate, and changes to the social and physical environment would have placed new stresses upon them, forcing them to modify their living practices in new ways. Climate change is projected to be particularly intense in the region, with a marked increase in maximum daytime temperatures by 2100. People usually adapt to the day to day weather by making small changes to the way they live, however how people cope with 'strong' weather (e.g. extreme heat, flooding) will become increasingly important. Understanding the implications of climate change will be important for designing effective adaptation that minimises the risks to people's lives. This presentation will discuss recent research that explores the experiences of Aboriginal people living in two different settings – Alice Springs Town Camps and the remote community of Lajamanu, in the Northern Territory. The research explores peoples' perceptions of climate change, and some of the adaptations people in these places have made to cope with 'strong' weather events. Contemporary housing has greatly improved the comfort of peoples' lives during 'strong' weather, yet there appears to be limited awareness about the limitations of the strategies (and associated costs) if the long term projections for climate change bear out. This is further complicated by the fact that responsibility for housing and associated infrastructure now rests with the government, limiting people's ability to invest in (particularly) low cost change through their Housing Associations.

(Student). A predictive model of Indigenous Ranger Groups' capacity for the adaptation of heritage sites to the impacts of climate change

Bethune Carmichael, PhD candidate ANU and Charles Darwin University

Grevillea Drive, PO Box 795, Alice Springs, Northern Territory 0871 Australia.
E: bethune.carmichael@cdu.edu.au, M: 0447 754 906

KEYWORDS: climate change, adaptation, Indigenous, cultural heritage, ranger group, framework

Internationally, a limited number of climate change adaptation risk analyses have been conducted for cultural heritage sites. These analyses constitute frameworks for such a process. However, they resulted in little if any actual adaptation planning or implementation. To date, climate risk analyses have involved limited stakeholder engagement. Yet adaptation theory underscores the importance of a stakeholder-led process in order to enhance the prospect of positive outcomes. In the Australian context, heritage sites on the Indigenous estate are often a part of ongoing cultural practice. Furthermore, such heritage sites are increasingly being managed by Indigenous ranger groups. In this context it is all the more fundamental that adaptation planning is 'bottom up'.

This paper seeks to modify an existing framework for heritage climate change adaptation so that it supports a stakeholder-led process. To this end, the paper identifies principles and considerations at the core of the small 'Indigenous community' adaptation literature, as well as generic climate change adaptation frameworks or products. It then uses these principles to modify a heritage climate change adaptation framework.

This modified, *preliminary* heritage adaptation framework will form a reference point for collaborative research in Central Australia and Arnhem Land

Climate adaptation decisions by local governments

Supriya Mathew^A, Rolf Gerritsen^A, Digby Race^B and Yiheyis Taddele Maru^C

^ACharles Darwin University,
Alice Springs, NT 0870, Australia.
E: Supriya.Mathew@cdu.edu.au

^BFenner School of Environment & Society,
ANU, Canberra, ACT. 0200.
E: Digby.Race@anu.edu.au, M: 0419 638 406.
Formerly CRC-REP and CSIRO.

^CCommonwealth Scientific and Industrial Research Organisation (CSIRO),
Alice Springs, NT 0870, Australia.
E: Yiheyis.Maru@csiro.au

Climate models indicate that Australia is likely to get hotter, with some data projecting a temperature rise in the range of 3 to 7° by 2100. Local adaptation responses will be required to mitigate the negative consequences of a warming atmosphere. Local governments will need to play an active role in local adaptation strategies so their communities are adequately prepared for the future climate. While most local governments in Australia face the challenge of decision-making under uncertainty, remote inland locations such as those in central Australia will face more complex decision-making environments due to remoteness and their typically heterogeneous populations. Despite the challenges for sound decision-making, effective adaptation responses are crucial. Adaptation decision-making will need to be embedded within the constraints and opportunities that are likely to arise as the climate and many other factors change. At the local government level, short term planning and transitional adaptation is likely to be a feature of adapting to climate change. Over longer time horizons a shift towards transformational adaptation will be required. In this paper we aim to understand adaptation decision-making for local government institutions in central Australia using the risk management framework.

Semi-continental scale rangeland conservation: developing an agenda

Rolf Gerritsen, Professorial Research Fellow

Charles Darwin University,
PO Box 795, Alice Springs NT 0871.
E: rolf.gerritsen@cdu.edu.au,
M: 0447 083 490

This paper is a development of earlier work (Schlesinger & Gerritsen 2010, Salmon & Gerritsen 2013). The Australian continent's rangelands have small populations scattered over huge areas and are characterised by extreme temporal variability and threatening eco-climatic processes. These threats spring from altered fire regimes, invasive plants and the problems of introduced animals, etc. Conservation of these vast rangelands needs money, the informed involvement of rangeland stakeholders; some measure of the trade-offs between production and conservation and clearer ideas about social and cultural benefit. It is difficult to assign widely agreed values to both these trade-offs and the social and cultural elements of rangeland conservation. So rangeland management has remained contested and riven by sometimes conflicting objectives.

Rangeland conservation needs to have four characteristics: broad-scale management, flexibility of responses to eco-climatic change; long implementation time frames and outcomes established via monitoring. Salmon & Gerritsen (2013) proposed a New Integrated Conservation system that featured a new fiscal ecology (introducing private capital to augment government grants), multiplex governance and mixed management multiple objectives. This paper elaborates and advances this development by applying Ostrom to create mechanisms that seek to replace current vertical networked interests to achieve horizontal networks and ultimately an Australian rangeland "commons".

Innovative transport options for enhancing liveability in Australia's rangelands

Bruno Spandonide

Ninti One Limited:
Cooperative Research Centre for Remote Economic Participation.
E: bruno.spandonide@nintione.com.au,
Ph: 08 7905 5530, M: 0431 335 025

KEYWORDS: transport, innovation, adaptation, remote Australia, rangelands

Affordable and functional transport is vital for the people and industries of Australia's rangelands. Transport systems in remote Australia are heavily dependent on private motor vehicles, in turn dependent on increasingly expensive petrol and road network – raising concerns that our current approach to transport is unsustainable. Remote Australia is also characterised by critical social inequalities in terms of people's access to different transport options. The challenge to provide a viable transport system across Australia's rangelands must also consider the implications of profound demographic, economic and climatic changes that are anticipated to occur over coming decades. Reflective of this context, remote Australia also has a history of being highly innovative at a 'grassroots' level, with many social and technical adaptations applied by households and businesses to maintain their livelihoods and operations.

Opportunities for creating new approaches to the transport systems in remote Australia include radical innovations (e.g. new fuels) and adaptations of existing options (e.g. improved coordination), and cover a range of technical, behavioural and operational dimensions. This article (presentation) will present an overview of the transport systems in remote Australia, and then discuss the emerging findings from the author's research to socio-culturally appropriate, energy efficient and economically viable options for improving transportation. Reimagining the transport systems in the rangelands is critical if we are to enhance the socio-economic status and wellbeing of Australia's remote communities.

No room for wild dogs, white ants or elephants: the imperative of leading practice as multi-dimensional adaptation strategy in Australian rangeland business and public policy

Glenn Ronan^A, Anne-Maree Dowd^B and Karen Cosgrove^C

^AFormer Research Economist, Climate Adaptation,
Primary Industries, Northern and Remote Australia,
Cooperative Research Centre-Remote Economic Participation,
Desert Knowledge Precinct, Alice Springs, NT.
E: glenn.ronan@nt.gov.au; M: 0401 121 897

^BCSIRO,
Kenmore, Queensland;
E: Anne-Maree.Dowd@csiro.au; Ph: 07 3327 4468

^CSocial Innovations Pty Ltd,
Perth, Western Australia,
E: karen.cosgrove@socialinnovations.com.au; Ph: 08 9490 7252

KEYWORDS: Leading practice, transformational adaptation, business strategy

The risks and costs of sub-optimal performance at any time, on any market or non-market challenge, including climate change converging into climate variability, necessitates capacity for superior strategy and action in Australian rangeland business. Garnaut's 2008 and 2011 reviews suggest that market forces will drive adaptation to climate change in agriculture. More recently, Garnaut warns that when stress exceeds capacity to absorb change effective functioning of fractures can be expected in human institutions and markets: things fall apart. Regional scrutiny is required to gauge adaptation to shocks from all sources. Exploratory research was conducted into the adaptation capacity of pastoralists in the rangelands of Western Australia using stakeholder engagement methods. The project focused initially on developing and piloting two holistic economic models, based on a four quadrant design and utilising theory from a Five Capitals approach. Analysis of the Murchison and Kimberley regions affirm evidence from prior industry and regional studies that highlight weaknesses in the Five Capitals, requiring transformational adaptation options to be considered in strategic planning and decision making processes in the regions. This will likely be necessary to increase the potential for reversal, of what is locally described as, 'a century of landscape degradation' with associated adverse financial, human and social impacts. Developing human and social capital, consistent with 'leading practice', is identified as the best strategy to lift financial and environmental outcomes. Conceiving and successfully implementing leading practice has individual, community and public policy dimensions where, in the case of the Murchison, consensus has emerged that there is no room for wild dogs or other vermin and, analogously, no room for 'white ants' (public policies that are impediments to performance). The researchers suggest that in business strategic planning there is also no room for 'elephants in the room', including risk managing climate change. Synergistic leading practice by private and public stakeholders is advanced as the best frame in which to grapple with the complexity of multi-dimensional adaptation within rangeland communities.

Keynote: Energy extraction and environmental outcomes

Dan Metcalfe

CSIRO Land and Water Flagship,
PO Box 2583, Brisbane QLD 4001.
E: dan.metcalfe@csiro.au,
Ph: 07 3833 5529, M: 0427 766 704

Energy extraction is not without its challenges from an environmental perspective, with unconventional gas attracting particular attention at present. Key concerns include contamination of ground water, changes to hydrological function, disruption of surface ecosystems and cumulative impacts, both spatially and temporally, to biological processes. However, in an energy-hungry world the extraction of energy from terrestrial resources will continue, so the challenge for managers of both the environment and the energy companies is to ensure that the detrimental effects of any extraction are minimised or compensated for. I will discuss government and industry initiatives to protect the environment while facilitating energy extraction, and to boost targeted conservation programs in areas where energy extraction may be having some impact. I will also consider appropriate monitoring requirements to assess change from existing baseline environmental conditions.

(Student). How do mining towns contribute community value?: Roxby Downs and Leigh Creek

Stuart Robertson, PhD candidate

CRC Remote Economic Participation and UNE Business School.
E: srobert9@myune.edu.au, M: 0412 669810

KEYWORDS: mine lifecycle, planning, mine closure, enduring value, community, social responsibility

The literature is replete with examples of communities which have suffered significant impacts from nearby mine operations and their subsequent closure. Increasingly, there is awareness amongst the International and Australian mining peak bodies for the need to plan for enduring value for communities that are reliant on nearby mines. Mining companies have embraced the concept of corporate social responsibility, endeavouring to maintain a 'social license to operate'. The concepts of enduring value and mine lifecycle planning may help to ensure companies meet this objective and communities endure beyond mine closure.

This paper presents the initial findings of research undertaken in Roxby Downs, Leigh Creek and surrounding communities in the North-east of South Australia. It explores the level and nature of the current economic and social dependence the surrounding communities have on these major centres. The paper also highlights the local residents' views of the amenity and the future of both centres, exploring the potential resilience of the outlying communities in the event of downsizing in the mining industry.

The findings indicate a high dependency on Leigh Creek by neighbouring communities along with a significant negative sentiment about the future viability of Leigh Creek without an expansion of population and continuation of mining. Furthermore, a significant majority of respondents felt there was no future for Roxby Downs post mining. The findings also indicate the communities surrounding Roxby Downs are yet to develop the dependency on this major centre as is evident in the case of Leigh Creek. The negative sentiment from respondents over the future of both major centres suggests planning will need to be undertaken to diversify the economic base, and particularly in Leigh Creek with ideally a need to increase the population, to ensure the enduring value of these major centres to the surrounding communities.

Mining partnerships - we can dig it!

Linda Anderson

Pilbara Mesquite Management Committee (PMMC),
PO Box 867, Karratha WA 6714.
E: linda@pilbaramesquite.com.au,
Ph: (08) 9144 1844, M: 0407 139 302

KEYWORDS: mining, Pilbara, land management, pastoral, weeds, leverage

With the big areas, big companies, big profits and big resources synonymous with the Pilbara region, how is our small, pastoral focused group making big waves with the Pilbara resources sector?

The Pilbara Mesquite Management Committee (PMMC) was one of the first community groups in the WA rangelands to focus on partnering with pastoral land managers in developing local solutions to one of the biggest threatening processes on coastal leases at the time – the invasion and domination of weeds.

Pastoralists, the government and our resource sector were faced with enormous challenges in maintaining and building their businesses in early 2000. Industries were changing and expanding and rapid development was occurring with little regard for the impact on landscapes, vegetation and people.

In the rapidly changing environment, the PMMC has thrived in a region known for its boom and bust cycles. Our transition into developing formal partnerships with resource companies and NRM groups has strengthened our group and enhanced our activities. Our annual operations are funded through external agreements with organisations such as Rangelands NRM. Our on-ground programs leverage over \$950,000 in external investment directly from resource companies into weed management annually.

We have a reputation of being committed to our projects, consistently working hard to make sure every investment is achieving the best outcomes for our pastoral industry, our environment and the primary production that relies on a weed-free landscape.

Our continuing success lies in playing to our strengths, never letting opportunities to be involved pass us by, and ensuring that no matter what we do, we can show you the threats at play and the positive benefits of actively, strategically and methodically working through to protect what we all rely on for our business activities – our natural resources.

Using water from mine dewatering for irrigating crops in the Pilbara and the implications for the wider community in the Western Australian rangelands

Sim Mathwin,
Superintendent Agricultural Projects

Rio Tinto Iron,
Level 7, Central Park, St Georges Tce, Perth WA.
E: simon.mathwin@riotinto.com
Ph: 08 6213 1170, M: 0439 927 505

KEYWORDS: mining; mine dewatering; irrigation; Pilbara; Rio Tinto; rangelands management

Mine dewatering is the process of abstracting groundwater from the portion of high value ore body lying below the watertable to enable mining. The volumes abstracted are often orders of magnitude greater than the mine requires for processing which results in large volumes of excess water being discharged to the environment. The water in the Pilbara is often of drinking quality and highly suitable for beneficial use.

In 2009 Rio Tinto made the decision to include irrigation as a component of its water management strategy for water being abstracted from the Marandoo Mine in the Pilbara. This project was called the Hamersley Agricultural Project (HAP). To this end land was cleared and centre pivot irrigators, covering approximately 800 hectares, were installed in an area 10 kilometres to the west of the mine site. First water was delivered to the irrigation area in September 2012. The HAP was sown to Rhodes Grass (a sub-tropical perennial) in October 2012 with first hay being produced in January 2013. A second project of about 900 hectares, The Nammuldi Agricultural Project (NAP) was commissioned in the first half of 2014 with first hay expected in November 2014, this area is also sown to Rhodes Grass. Rhodes Grass is a good quality fodder which can be used for maintenance feeding of cattle while in the yards during mustering or strategically placed at water points for long term supplementary feeding.

There is significant evidence to suggest that the managed grazing of cattle in the Rangelands improves plant health and vigour for improved long term grazing and plant density. This benefits both the environment and the pastoral value of the land. Currently it is very difficult to manage grazing because of the lack of suitable, cost effective supplementary fodder. Operations like HAP and NAP, which can now supply good quality, value for money, fodder into the region has the potential to change the way pastoralists manage their stations in the Pilbara.

Stacks of fire – proving the theory

Kate Masters

Glencore Mount Isa Mines,
PMB 6, Mount Isa Qld 4825.
E: kate.masters@glencore.com.au,
M: 0402 783 100

KEYWORDS: fire, method, engagement, stakeholder, biodiversity, management

The 66,640km² Mount Isa Inlier/Northwest highlands 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 Mount Isa Mines copper, lead and zinc open cut, underground mining, processing/smelting operations, ancillary utilities and distribution services and large pastoral holdings. A biodiversity assessment conducted on the Mount Isa Mines 35,000ha Mining Lease in 2009 identified large scale, intense wildfires to be a key threat to biodiversity. 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. An on-ground implementation fire management program commenced in 2011, continues into its fourth season with full support of mining operations and four neighbouring pastoral holdings. The fire management program is encompassing both asset (mining infrastructure, local airport and high-voltage powerlines network) protection and biodiversity outcomes. The two key principles applied for the successful delivery of the project are; extensive engagement of stakeholders, considered of particular importance due to the heightened awareness of the detrimental impacts of fire in the area and the burning implementation techniques applied. The success of engagement has been demonstrated by the ease at which the burning implementation can be carried out in close proximity to mining infrastructure and with neighbouring property holders. The parameters which attribute to the high rate of success with this program included no mine shut downs or production interference during the burns. The burning method hypothesis utilised has been tested with a series of 'experimental method' burns in 2014 to enhance fire behaviour understanding. The experiment tested the wet season against the wind, patchy ignition method verses the dryer season, single line with the wind method to ascertain impact on vegetation damage, germination and soil health.

Martu Living Deserts Project – partnering for conservation led by Indigenous people

Tony Jupp^A, Peter See^B and Martu rangers^C

^AAridlands Project Manager,
The Nature Conservancy,
E: tjupp@tnc.org, M: 0428 945 560

^BChief Executive Officer,
Kanyirninpa Jukurrpa,
E: Peter.See@kj.org.au, M: 0419 732 970

^CKanyirninpa Jukurrpa

KEYWORDS: Martu, conservation, partnership, country, culture, threatened

While many of Australia's aridlands have suffered either total loss or serious declines of native fauna, the Martu lands in WA's Western Desert in the eastern Pilbara provide one of the last wild havens for some of Australia's iconic but highly threatened desert species.

With support from the Australian Government, an innovative partnership between The Nature Conservancy (TNC), BHP Billiton Iron Ore (BHPBIO) and the Martu people (represented by Kanyirninpa Jukurrpa – KJ) is achieving exciting social, cultural, economic and environmental outcomes. TNC has been able to bring its strategic conservation planning experience in landscape scale projects to assist the Martu people build capacity and fulfil their desire to preserve their culture while actively managing their 13.6 million hectare native title determination area.

Through KJ as the local delivery partner, Martu people are returning to work on country to:

- clean and protect water holes;
- improve fire management;
- manage feral herbivores and predators;
- manage cultural heritage;
- protect priority threatened species (such as the Greater Bilby); and
- translocate rock-wallabies (and potentially other species) into their former habitats.

The project provides significant employment opportunities for Martu men and women in ranger teams working throughout the native title area. It is also generating measurable social, cultural and economic benefits for Martu people and environmental benefits for part of the most intact arid ecosystem anywhere on Earth.

(Student). New cross cultural monitoring for effective management of indigenous lands: a case study from western Arnhem land

Jeremy Freeman, PhD candidate

Charles Darwin University,
E: freeman_jeremy@yahoo.com,
M: 0410 728 270

KEYWORDS: indigenous land management, cross cultural monitoring

The rapid growth of Indigenous owned and managed conservation areas in Australia and internationally represents a new paradigm in land management. Known in Australia as Indigenous Protected Areas (IPAs), they have expanded from a single 55,000 ha region in 1998, to 65 IPAs in 2014, totalling over 50 million ha, now constituting around 40% of Australia's National Reserve System. Covering vast swaths of rangeland these IPAs include some of Australia's most biodiverse and intact landscapes. Although predominately under sole indigenous management, IPAs require multiple external partnerships for effective land management. Therefore it is necessary to move beyond the dominant indigenous/ government 'joint management' model.

Environmental monitoring is essential for effective management of protected areas. Recent critiques of environmental monitoring however have been highly critical of its value; consequently new monitoring frameworks are emerging. These models however are designed for a scientific and bureaucratic context and are not well suited to the unique cultural, geographic and economic circumstances of IPAs. Their application on indigenous lands results in esoteric monitoring programmes which, without community support, are unsustainable. This research created a new cross cultural monitoring framework, integrated with indigenous land management whilst also satisfying the requirements of funding bodies and other partners. Cross cultural monitoring requires a shift from the dominance of compliance monitoring and externally driven research, to a monitoring programme where indigenous understanding of country directs all facets of the monitoring cycle; from inventory, to research, to assessing management outcomes, whilst simultaneously communicating with multiple audiences.

The endemic, fire sensitive *Allosyncarpia ternata* dominated forests of the Arnhem Plateau provided a case study within the Warddeken IPA to demonstrate the cross cultural monitoring process. In doing so it produced more functional datasets, customised tools, key ecological research findings and importantly increased indigenous re-engagement with these ecologically and culturally significant forests.

Identification of refugia in western NSW

Tony Gill^A, Geoff Horn^A, Harvey Collerton^B, Russell Grant^B, Anna Hanson^B and Neil Flood^C

^AOffice of Environment and Heritage,
PO Box 1020, Dubbo NSW 2830.
E: Tony.Gill@environment.nsw.gov.au, Ph: 02 6841 0915;
E: Geoff.Horn@environment.nsw.gov.au, Ph: 02 6841 0917

^BWestern Local Land Service,
PO Box 307, Cobar NSW 2835.
E: Harvey.Collerton@lls.nsw.gov.au, Ph: 02 6841 2754;
E: Russell.Grant@lls.nsw.gov.au, Ph: 02 6836 1575;
E: Anna.Hanson@lls.nsw.gov.au, Ph: 02 6870 8263

^CJoint Remote Sensing Research Program,
GPO Box 5078, Brisbane, Qld, 4001.
E: Neil.flood@science.dsitia.qld.gov.au, Ph: 07 3170 5677

KEYWORDS: refugia, landscape, climate, remote sensing, time-series, Landsat

The Western CMA catchment is large, covering 40% of NSW, with a range of Landsystems and vegetation community types. Under future climate change scenarios, western NSW is more likely to experience longer periods of hot, dry weather. This may pose problems for terrestrial biota that are not well adapted to warmer conditions. There is a paucity of on-ground studies in western NSW that have assessed sites for their potential as suitable refuge areas during periods of hot, dry weather.

Recent studies suggest that convergent environments, such as deep valleys and gorges, are potential refuge sites because their local climate is decoupled from the regional climate, making them environmentally stable. These environments may be characterised by higher soil moisture with denser, more persistent vegetation than the surrounding region on a similar land system. This is due to them being in water run-on areas where moisture and nutrients accumulate, and in areas of cold-air drainage, with lower daily insolation, and sheltered from hot, dry wind.

Due to the large size and inaccessible nature of Western NSW, an innovative remote sensing based approach to identifying potential refuge sites has been proposed. Several remotely-sensed datasets have been used within a decision-support tool environment, combining local, expert knowledge, with a regional view provided by the data to identify the potential location of refugia in western NSW.

Landscape position indices derived from the SRTM DEM along with Landsat time-series derived datasets including water occurrence and persistent green vegetation have been combined in a GIS environment to create rule-sets for identifying refugia specific to each landscape type, as it is unlikely that a single rule-set will be applicable across the entire catchment. The results of the project to map refugia locations in western NSW are presented here.

Manta Palyakutu: Ngurra kantilya kanyini! **Land use and management led by Anangu on Anangu land** **near Indulkana, APY Lands of South Australia**

Willy Wara Edwards and Walter Tjami

Martu Yankuntjatjara, APY Lands, South Australia

The land suffered under pastoral management by outsiders across the eastern APY Lands. Grazing management was no better (perhaps worse) than before when we got the APY Act and agistment began. We explain how we are changing this using the EMU™ Process with support from APY Executive, AWNRM Board and others. We plan what can happen and where on our land, protect sacred places and special ecosystems and start planning our own businesses that “fit” our land-culture. This programme we call Manta Palyakutu (really healthy/good land): Ngura kantilya kanyini (looking after our places really strongly). This is the story of our progress so far on my ancestral land. We are grateful for support from the APY Executive, Commonwealth Government and AWNRM Board.

What I want for my ancestral lands is to look after them as well as my predecessors, for my family and friends to want to do the same and to enjoy old and modern things enabled by our own businesses - not grants and reliance on other people. We must support our land-culture ourselves.

MTP Contracting: Running a remote NRM business on the Barkly Tablelands

Joy and Maxie Priest

MTP Contracting,
Corella Creek, via Tennant Creek
PMB 24, NT. 0860.
E: joypriestis@hotmail.com,
Ph: 08 8964 4789

KEYWORDS: indigenous, Barkly, NRM, weeds, fee-for-service, innovation

MTP Contracting is an Indigenous business operating out of Corella Creek Community in the Barkly Tablelands, NT. Established originally as a contract mustering business, MTP has expanded into NRM as a weed spraying business providing a targeted, on-ground effort in the battle to manage Parkinsonia and other woody weeds on the Barkly, and was also recently involved in a drought refuge survey of ephemeral waterholes in the area. This presentation will provide an overview of why MTP Contracting was established by founders and directors Joy and Maxie Priest and talk about the challenges faced in developing livelihoods in NRM on this remote community, the projects completed and the hopes for the future. The business model builds on strong relationships with regional stakeholders, knowledge of country, and an unwavering commitment to reside on the Barkly alongside the 5% of the population who call the Australian outback home. The business is now in its fourth year and has employed over 20 staff during that time, providing formal and informal training to ensure skills are maintained and enhanced. As a result, MTP has established strong relationships with the pastoral industry, in particular Australian Agricultural Company, Barkly Landcare and Territory Natural Resource Management, and has become an influential organisation in the Barkly and beyond.

Challenging the concept of Aboriginal mosaic fire practices in the Lake Eyre Basin, with particular focus on the Cooper Creek country and adjoining Simpson Desert, 1845-2015

R.G. (Dick) Kimber^A and M.H. Friedel^B

^APO Box 2436, Alice Springs, NT 0871

^BCSIRO Land & Water, PO Box 2111, Alice Springs, NT 0871.

KEYWORDS: mosaic burning, Channel country, spinifex, settlement, fire management

In the many discussions over the last forty years about the significance of Australia-wide Aboriginal fire practices, one concept that has become common is the importance of 'mosaic burning' for the management of country (e.g. Gammage 2011), that is, the deliberate creation of a mosaic of patches representing different fire histories. Aboriginal people undertook mosaic burning, it is said, for a variety of reasons, based on traditional knowledge of landscapes, seasons, animals and plants, and an ability to control fire. But how widespread was this practice? Was it as universal as is sometimes suggested?

Our starting point in this study (with our emphasis) is a quotation by historian Helen Tolcher, referring to early 1951:

"There were reports of bushfires burning along the New South Wales and Queensland borders - a *new phenomenon* in the Cooper country ---" (Tolcher 1999:144).

Evidence will be presented both for and against this statement, indicating that terrain, the changing nature of vegetation, seasonal conditions, the presence or not of Aborigines, the stocking of the pastoral country and spread of feral animals, and government policies about fire can all be of relevance.

In that the use of fire by rangers and others to recreate a vegetation mosaic is often recommended in remote Australia, and is being advocated by some Australia-wide, is there a need to pause? In particular, what are the ramifications for the future management of the desert areas under consideration?

REFERENCE:

Gammage, B. (2011). *The biggest estate on earth: how Aborigines made Australia*. Allen & Unwin, Sydney.

Tolcher, H.M. (1999). *Rogues and heroes: policing the Cooper 1876-1952*. Fast Books, Sydney.

Understanding climate science supports adaptation in indigenous rangeland management

Fiona Walsh^A, Jocelyn Davies^A, Shannon Lander^{B*}, Michael Carmody^C, Ro Hill^D, Meg Mooney^E, Ashley Sparrow^F and Ltyentye Apurte Rangers^{B*}

^ACSIRO Land & Water Flagship, Business & Innovation Centre, Desert Knowledge Precinct, South Stuart Highway, Alice Springs NT 0870. E: fiona.walsh@csiro.au

^BCentral Land Council, Ranger program, Ltyentye Apurte/Santa Teresa, NT 0872

^CCentral Land Council, Land Management, Cameron St, Alice Springs, NT 0870

^DCSIRO Land & Water Flagship, Australian Tropical Forest Institute, James Cook University, Cairns, Qld 4870

^ETangentyere Land & Learning, Tangentyere Council, Alice Springs, NT 0870

^FCSIRO Land & Water Flagship; Floreat, WA 6014

*Conference presenters: Shannon Lander and staff of the Ltyentye Apurte Ranger group

KEYWORDS: climate adaptation, Aboriginal land management, climate literacy, land restoration, Aboriginal community rangers

We report on a collaborative project about climate change and adaptation. The project's overall goal was to find good ways to build desert Aboriginal people's understanding of climate change and their capacity to adapt to it. This project made knowledge of climate change more accessible to desert Aboriginal people. It has started to help Aboriginal community rangers recognise how climate change contributes to landscape change. The Ltyentye Apurte (Santa Teresa) ranger group, several other staff from Central Land Council's Land Management section, four CSIRO scientists and a Tangentyere Council science educator were involved in the project.

We found that the Aboriginal people had made many observations of environmental changes but they have fragmented understanding of the causes of climate change as understood by scientists. Science learning built on the rangers' knowledge of weather from their own life experience. Scientists on the project team used graphs of temperatures and rainfall to explore changes over time visually. For example, Alice Springs records show a steady increase in the number of days over 40°C since the 1970s. The rangers and science educator then developed and gave presentations about climate change to other Aboriginal groups. A 'big book' was made for desert Aboriginal people based on the presentations.

Practical activities were integrated into the project. These focused upon soil erosion and erosion management as these had been an important part of the rangers work program and are impacted by climate change processes. Following a tour of Woodgreen Station, the rangers surveyed and constructed some erosion control banks. Future monitoring in these areas will help rangers, CLC and others to continue learning about catchment repair and the role of weather events in affecting catchment condition.

The use of camera traps to investigate wildlife usage of remote waterholes in central Australia

Jayne Brim Box^A, Martin Campbell^B, Tracey Guest^B, Kathy McConnell^A, Debbie Mitchell^A, Pat Hodgens^A, Lisa Thurston Bledsoe^A, Paul Box^A, Adlin Botkin^A and Donna Digby^A

^AWildlife Use and Pest Animals, Flora and Fauna Division,
Department of Land Resource Management,
Alice Springs, NT. E: Jayne.brimbox@nt.gov.au

^BCentral Land Council,
Alice Springs, NT.

KEYWORDS: central Australia, waterholes, camera traps, competitive cascades, feral camels

Central Australian waterbodies can be biological hotspots and areas of high endemism for aquatic species, and most have great cultural significance to local Aboriginal people. Until recently little work has been done to quantify their importance to terrestrial wildlife, or investigate if the presence of large feral herbivores, such as camels, impacted on native wildlife usage. Since 2007 we have worked closely with Traditional Owners and Indigenous ranger groups to deploy camera traps at over 20 sites across central Australia, from the Simpson Desert to the east, the Tanami Desert to the north, and the Petermann Ranges to the southwest. Over 1.5 million images have been obtained to date from a combination of camel-accessible and non-accessible sites. We used co-occurrence occupancy and niche overlap models to investigate if camels competitively excluded native species and to what extent exclusion occurred. We constructed activity budgets for a subset of species, and investigated how these budgets changed due to camel presence and other covariates. Not surprisingly waterholes were heavily used during times of extreme drought, but overall usage remained high even during wetter periods. The presence of camels at a waterhole significantly reduced the probability of native wildlife using the waterhole at the same time, and in some cases triggered a “competitive cascade” whereby native species were displaced by apex predators that had been displaced by camels. Our data suggest that central Australian waterholes are an important resource for a variety of native wildlife species, even those thought to rarely need water.

The Australian Feral Camel Management Project – a model for managing the impacts of large feral herbivores at the landscape scale

Glenn Edwards^{AE}, Donna Digby^A, Ross Bryan^A, Kym Schwartzkopff^B, Quentin Hart^C and Andy Bubb^D

^{*}Department of Land Resource Management, PO Box 1120, Alice Springs, NT 0872

^ADepartment of Land Resource Management, PO Box 1120, Alice Springs, NT 0871, Australia.

^BParks and Wildlife Commission of the Northern Territory,
PO Box 1120, Alice Springs, NT 0871, Australia.

^CDepartment of Primary Industries/Biosecurity NSW, Queanbeyan, NSW 2620.

^DNinti One Ltd, PO Box 3971, Alice Springs, NT 0871, Australia.

^ECorresponding author: E: glenn.edwards@nt.gov.au, <http://lrm.nt.gov.au>

KEYWORDS: landscape scale, feral herbivore, partnerships

Feral camels are a major degrading threat to Australia's desert landscapes. From 2009-2013, the Australian Feral Camel Management Project (AFCMP) attempted to manage the impacts of feral camels at 18 environmental assets across an area of 660,000 km² that included parts of Queensland, South Australia, Western Australia and the Northern Territory (NT). This area was a mix of aboriginal, pastoral, conservation and crown land. The project involved 20 partners including industry peak bodies, governments, Aboriginal organisations and non-government conservation groups. Through the application of an integrated management strategy, the project reduced the density of feral camels to target densities at 14 of the 18 assets and largely achieved the target density at the others.

The project's success at the national level was underpinned by six key factors:

- 1 Extensive consultation before any management was undertaken.
- 2 Respect for the values and motivations of different stakeholders.
- 3 Robust governance structure which allowed all stakeholders to be involved in the planning, implementation and evaluation of management activities.
- 4 Adoption of a robust monitoring framework to justify activity and expenditure.
- 5 A focus on animal welfare and operator safety. The project went to great lengths to ensure that all management was humane and safe for operators and in accordance with best practice.
- 6 Adoption of a flexible approach to management which allowed the project to adapt to changing landholder needs and environmental conditions.

In the NT, a number of arrangements that were put in place during the project were identified as critical turning points in respect of the safe and efficient application of camel management in that jurisdiction. These will be discussed. The AFCMP was the first landscape-scale project undertaken in Australia to manage the impacts of a pest animal without the solid legislative support that underpinned a program such as the Brucellosis and Tuberculosis Eradication Campaign. Given the project's success in meeting its main management objective, the AFCMP should serve as a useful model for the implementation of any future projects of a similar nature.

Is more or less fire needed in northern savannas? Fire history (and optimal management) varies with land use and land type

Robyn A Cowley^A and Dale Jenner^B

^ADepartment of Primary Industry and Fisheries,
PO Box 1346, Katherine NT 0851.
E: robyn.cowley@nt.gov.au, M: 0419 829 493

^BDepartment of Primary Industry and Fisheries,
PO Box 8760, Alice Springs, NT, 0871.
E: dale.jenner@nt.gov.au, Ph: 08 8951 8152

KEYWORDS: fire frequency, fire management, savanna burning

Fire management recommended for biodiversity conservation and reducing greenhouse gas emissions (reduce late dry season fire) contrasts to that for managing woody plant thickening on pastoral lands (increase late dry season fire). To investigate whether contrasting fire regimes are justified, fire history derived from AVHRR imagery was used to analyse fire frequency between 1997 and 2010 in the Victoria River District (VRD) of the Northern Territory. Fire frequency for all fires (January to December), and late dry season fires (August to December) were derived for different land uses (defence, national park, indigenous, indigenous pastoral and pastoral) and broad land types. Fire frequency was lowest on pastoral land where 32% of pastoral land burnt less than 1/10 years, cf. 3-4% of indigenous, park and defence land. Fire frequency was highest on defence and park land with 84 and 67% respectively burning \geq once every three years, followed by 50 and 44% of Indigenous and Indigenous pastoral land respectively. On grazed land tenures the frequency of fire varied across land types. High grazing value land types burned the least, while low grazing value land types burnt the most. Our analysis shows that areas that are not grazed experience high average fire frequency and will benefit from fire reduction strategies. Conversely, the very low fire frequency on the most productive pastoral land types is likely to have contributed to observed woody thickening in the region. In these important pastoral land types increasing fire frequency may assist to manage woody cover and improve or maintain pastoral productivity. In contrast, where there is a high fire frequency on low productivity pastoral lands (which are often not grazed), there may be opportunities for participation in approved savanna burning methodologies in carbon markets to reduce fire frequency and extent and greenhouse gas emissions.

Traditional hunting of feral cats to help protect key threatened species at Kiwirrkurra

Kate Crossing^A, Rachel Paltridge^B and Nolia Napangarti^C

^ACentral Desert Native Title Services,
Alice Springs, NT
E: katecrossing@centraldesert.org.au,
M: 0409 206 287

^BDesert Wildlife Services,
Alice Springs, NT.
E: desertws@bigpond.net.au,
Ph: 08 8952 1696

^CKiwirrkurra community, WA.
Ph: 08 8956 4975

KEYWORDS: feral cat, bilby, great desert skink, hunting, biodiversity protection, Kiwirrkurra

Kiwirrkurra country, in the remote Gibson Desert, hosts important populations of two key threatened species: bilby and great desert skink. These species are sparsely distributed throughout the western desert regions, and are declared as Vulnerable under the EPBC Act. Predation by feral cats and unsuitable fire regimes are two key threatening processes for both species.

Like many other desert Aboriginal groups, Kiwirrkurra people regularly patch burn their land whilst hunting. Kiwirrkurra people also have a long tradition of hunting feral cats for food, and importantly still undertake this activity today.

Recognising the significance of this unique skill, a program was set up in mid-2014 to maintain and expand traditional cat hunting in key bilby and great desert skink habitats. The program encourages the retention and passing on of this skill through:

- Reimbursement of costs for successful cat hunts, through direct payment to the hunter,
- Data collection on who hunts, and when and where cats are caught,
- Analysis of stomach contents by a wildlife ecologist (guts are kept and frozen for later analysis), and
- Two-way knowledge sharing on the value of cat hunting for biodiversity and culture.

The cat hunting program is complemented by regular patch burning in the same areas, both as part of Kiwirrkurra people's daily life and through paid land management work. Regular (bi-annual) monitoring of the distribution and abundance of both threatened species and feral predators is being undertaken to assess the impact of this program on both populations. A key indicator will be the persistence (or otherwise) of known bilby and great desert skink populations.

Land of extremes: optimising a rearing and release strategy in response to climate and distance for a parkinsonia biological control agent in the Northern Territory

Louis Elliott, Bert Lukitsch and Natasha Burrows

Weed Management Branch,
NT Department of Land Resource Management,
PO Box 496, Palmerston, NT 0831.
E: louis.elliott@nt.gov.au

Parkinsonia is a weedy shrub with long thorns that can form thickets along watercourses and on floodplains in rangelands of northern Australia. It has negative impacts on production and the environment by replacing desirable vegetation and impeding mustering and access. In 2013, a new biological control agent, the parkinsonia moth *Eueupithecia cisplatensis*, became available and is currently being reared and released throughout northern Australia. A colony for mass rearing has been established by the Northern Territory Government's Department of Land Resource Management, where larvae and pupae are produced for release at sites across the Territory including the Katherine Region, the Barkly Pastoral District and Victoria River District. The larvae rely on a supply of good quality parkinsonia leaves to survive and reproduce. However, in the Northern Territory, a harsh climate means that parkinsonia stand health fluctuates dramatically with seasonal variation – many parkinsonia plants drop their leaves in response to annual drought in the late dry season, reducing the food supply on which the larvae depend. Conversely, during the wet season, many areas become inaccessible due to flooding making it impractical to release the moth at this time. In addition, parkinsonia is widely distributed across large areas of the Northern Territory which has very low population density. Some areas are able to be visited on an opportunistic basis, but it is difficult and expensive to make return visits for follow up releases. Taking these factors into account, a rearing and release strategy that optimises likelihood of establishment against cost will minimise investment of resources when access and plant health is limited, and maintain a pulse rather than stable production system. This will result in a greater number of larvae and/or pupae per release, but require fewer releases.

Validating satellite imagery products of woody thickening using aerial photograph interpretation: methods and preliminary results

Rebecca Gibson^A, Geoff Horn^A, Tony Gill^{AD}, Robert Denham^{BD}, Fiona Watson^B, Russell Grant^C

^AOffice of Environment and Heritage, NSW.

E: Rebecca.Gibson@environment.nsw.gov.au, Ph: 02 6022 0626;

E: Geoff.Horn@environment.nsw.gov.au, Ph: 02 6841 0915;

E: Tony.Gill@environment.nsw.gov.au, Ph: 02 6841 0914

^BQld Department of Science, Information Technology, Innovation and the Arts, Qld.

E: Robert.Denham@science.dsita.qld.gov.au, Ph: 07 3170 5676;

E: Fiona.Watson@science.dsita.qld.gov.au, Ph: 07 3170 5670

^CWestern Local Land Service, NSW.

E: russell.grant@lls.nsw.gov.au, Ph: 02 6836 1575

^DJoint Remote Sensing Research Program,
University of Queensland

KEYWORDS: Landsat, aerial photograph interpretation (API), woody thickening, western NSW

The increase in woody plant density in grasslands and the conversion of open woodlands into shrublands (i.e. woody thickening) is a phenomenon that has been increasingly reported in the past decade and is particularly common across arid and semi-arid regions of Australia. While woody thickening may reduce biomass available for domestic livestock grazing, there are some significant benefits for carbon sequestration and biodiversity (e.g. increased diversity and abundance of in some regions for some taxa). The goal of this project was to investigate the trends (increasing or decreasing) in woody vegetation cover across western NSW to inform assessments of carbon potential, landscape productivity and habitat change. Landsat imagery from 1987 to present was used to develop models of linear trends in persistent green cover over time ('trend product'). Trends in persistent green cover are expected to represent the woody, rather than herbaceous, component of vegetation change. Aerial photograph interpretation (API) was used to validate the use of persistent green index as an accurate measure of woody cover change by determining whether a change detected in the trend product appeared as a change (positive or negative) in the aerial photographs, and vice versa. Further investigations aim to determine whether the nature of the relationship between the API results and the trend product change according to land system/ landscape position, or any other discernable factors. The methodology presents an advanced and novel development in the use of remote sensing for natural resource management.

Ngadju fire and conservation land management

David Graham

Ngadju Conservation.

E: dayboy117@yahoo.com.au, M: 0498 056 481

Please cc Peter Price on all correspondence to David

E: peter.price@greatww.org, M: Peter Price 0418 926529

In 2014 Ngadju were granted Native Title over some 10 million hectares of southern Western Australia, including exclusive possession over 5 million hectares of unallocated crown land in the Great Western Woodlands.

The determination recognised Ngadju's uninterrupted connection to country and the desire of many Ngadju to maintain their strong cultural links into the future. Ngadju Conservation was established in 2012 to coordinate and manage conservation land management programs on behalf of the broader Ngadju native title claim group. The core objective was to link the many components of land management into future employment and economic opportunities that created jobs on country. This is being achieved through the establishment of a ranger program focusing on fire training for wildfire suppression and mitigation, the development of a conservation action plan to identify a land management strategy plus surveying and mapping of invasive weeds and malleefowl.

Through a partnership with Gondwana Link, Rangeland NRM, Shire of Dundas and Department of Fire and Emergency Services we are in the final stages of developing the Conservation Action Plan and have established the Dundas Rural Bushfire Brigade. We engaged in a cultural and land management exchange with Martu rangers operating within the Birriliburu Indigenous Protected Area and our current program includes assisting in the development of regional 10 year fire strategy with Department of Fire and Emergency Services and Dundas Shire and training in Indigenous Land Management Certification 111.

NRM planning for climate change in the rangelands

Mary-Anne Healy and Andrew Burrow

Ninti One,
PO Box 3971 Alice Springs NT 0871.
E: Maryanne.healy@nintione.com.au,
M: 0438 890 947

KEYWORDS: climate change, NRM planning, research, adaptation, rangelands, climate change impacts

Across Australia a series of projects have been running to gather climate change information and make it relevant and useful for NRM groups to assist in their regional planning processes. The aim is to enable the NRM groups to plan for climate change impacts as part of the NRM plan for their region.

The Rangelands Cluster Project worked across seven NRM regions in the rangelands: Rangelands WA, Territory NRM, Alinytjara Wilurara NRM, SA Arid Lands NRM, Desert Channels Qld, South West NRM Qld and Western Local Lands Services. Researchers from CSIRO and the University of Canberra prepared information and tools to inform and support climate change planning in the rangelands.

This paper provides examples from two of those regions and presents how they took the information that was delivered by the Cluster Project, the National Projections Project and other climate change research, and used it to inform their NRM planning processes.

The Territory Conservation Agreements program: promoting integrated conservation management

Jon Hodgetts

Territory Natural Resource Management,
GPO Box 2775, Darwin, NT. 0801.
E: Jon.hodgetts@territorynrm.org.au,
Ph: 08 8952 3522

KEYWORDS: natural resource management, conservation, pastoral, partnership,
off-reserve, production

Territory Natural Resource Management (TNRM) is a non-for-profit community organisation which partners with a range of stakeholders to sustainably manage natural resources in the Northern Territory. TNRM introduced the Territory Conservation Agreement (TCA) program in 2011 to encourage landholders to protect areas on their property with high conservation significance. The TCA program aims to raise awareness among landholders of the benefits of integrated conservation management. It establishes a precedent for conservation on high value sites, and strengthens the off-reserve conservation network. Priority is given to sites located within poorly represented bioregions that provide habitat to rare or threatened species, or that contain important ecological communities. TCAs seek to demonstrate the benefits of integrated approaches to conservation, including multiple land uses. Currently 24 TCAs have been established. These are located across nine bioregions with six of the nine covering underrepresented bioregions in the National Reserve System. Feedback from the landholders involved in the program for more than one year has been positive, with reports including good business outcomes as well as increased protection to assets such as water quality and native species on their property. The findings so far illustrate that by involving the landowner in the process of developing the management actions appropriate for the site the outcomes are more likely to include both conservation and productivity benefits. This is more likely to encourage landholders who may not otherwise have considered participating in a program which was viewed as being only conservation based.

Habitat distribution modeling of *Halocnemum strobilaceum* and *Artemisia sieberi* species using Maximum Entropy Method (Maxent) in QUM Province rangelands

Hossein piry sahragard

Assistance Professor,
Range and Watershed Department,
University of Zabol, Iran.
E: hpirys@ut.ac.ir

KEYWORDS: Maxent, geostatistics, potential habitat, AUC, Kappa coefficient

Predictive modeling of species geographic distributions and habitats identification in different plant species has an important role in the conservation and rehabilitation of rangelands. The Objective of this study was to estimate geographical distribution of *Halocnemum strobilaceum* and *Artemisia sieberi* species, Finding the most important variables in the distribution of these species, as well as Understanding tolerance range of these species to environmental factors in Qom province rangelands. Maps of the environmental variables were constructed using GIS and Geostatistics. Then predictive maps of species distribution using maximum entropy method (Maxent) and presence data species were made. The correspondence of predictive with real maps was evaluated using Kappa coefficient were assessed. Also Accuracy of the predictive models was evaluated using the area under the curve (AUC). According to the results, gravel factor in the first and second of soil depth, The electrical conductivity of first depth and sand content in second depths have the greatest impact on distribution of *Halocnemum strobilaceum* species Whereas lime amount in first depth, Amount of Silt in the first and second depth and acidity of the first soil depth have the greatest role in distribution of *Artemisia sieberi* species. Compliance of the actual and predicted maps for both species was very satisfactory level (Kappa coefficient was .74 and .70 for *Halocnemum strobilaceum* and *Artemisia sieberi* species respectively).

Developing biophysical and socio-economic indicators of rangeland health

John A Ludwig^A, Gary N Bastin^B, Jocelyn Davies^C and Teresa J Eyre^D

^AFormerly CSIRO Ecosystem Sciences,
Box 780, Atherton, QLD 4883 (retired);
current address, PO Box 900, Tolga, QLD 4882.
E: lasr@tpg.com.au

^BFormerly CSIRO Land & Water,
PO Box 2111, Alice Springs, NT 0871.
E: gary-bastin@bigpond.com

^CCSIRO, Desert Knowledge Precinct,
Alice Springs, NT 0871.
E: jocelyn.davies@csiro.au

^DQueensland Herbarium, Queensland Department of Science,
Information Technology, Innovation and the Arts.
Mt Coot-tha Road, Toowong, QLD, 4006.
E: teresa.eyre@science.dsitia.qld.gov.au

KEYWORDS: biodiversity conservation, landscape function, rangeland monitoring, social well-being

Maintaining healthy rangelands rich in social, cultural and environmental values depends on monitoring indicators of these values. Monitoring biophysical indicators, such as changes in cover of perennial vegetation, has provided useful information for land managers. But, even measuring this relatively straightforward biophysical attribute at adequate frequencies and spatial scales is a challenge, as discussed in other conference papers. Measuring other biophysical indicators of healthy rangelands, such as the diversity of plants and animals, has presented even greater challenges—again mostly because scale issues. Then, there are the challenges of measuring useful socio-economic indicators of rangeland vitality. Economic indicators have received considerable attention because of their importance to individuals, and to institutions from local to national scales. But, developing useful indicators of the social well-being of people living and managing rangelands has, perhaps, presented those responsible for rangeland monitoring with the greatest challenge. In this poster, we highlight some recently developed indicators that are proving useful for monitoring changes in the health of rangelands. We specifically describe a biophysical indicator of the capacity of landscapes to capture and retain rainwater and soils. We also look at a core set of 15 biodiversity indicators that have been identified as being useful for monitoring rangelands at local site to landscape scales. Lastly, we describe social indicators that evaluate the level of engagement and networking of people in rangelands. Although this poster can only highlight these indicators, we described them in more detail in our recent Range Management Newsletter article [14/2, 15 July 2014].

A novel community approach which incorporates improving landscape function to naturally combat *Acacia farnesiana* encroachment.

Marla Oodnadatta Natural Recourses Management Group

Natural Resources SA Arid Lands, PO Box 556, Coober Pedy, SA 5723.

E: janet.walton@sa.gov.au, M: 0408 807 498

KEYWORDS: restore, landscape function, catchment, community, workshop, monitor

The Marla Oodnadatta NRM group are trialling a community driven landscape function approach to weed control in the Peake Creek and lower Neales catchments.

During 2009 the Group identified *Acacia farnesiana* as a problem plant. Whilst this plant is not technically classified as a weed due to it being introduced to Australia prior to European settlement, it is a recent arrival to the Upper Peake Creek catchment. Anecdotal information and pastoral records indicate that the plant was introduced inadvertently during the 1980s when properties were restocked after the tuberculosis eradication campaign.

The Group sought funding to control the unwelcome visitor as part of a larger SA Arid Lands NRM Board Caring For our Country (CFoC) funding bid. The Group initially applied for two years funding to: identify the distribution of *Acacia farnesiana*, undertake a catchment approach to controlling its spread using Ecosystem Management Understanding (EMU)TM principles and raise community awareness of the problem and its potential to become a much larger and expensive problem throughout the region.

Consultants worked with land managers to undertake a survey of *Acacia farnesiana* distribution throughout the catchment. This information was then disseminated to all land managers in the catchment through a workshop on Evelyn Downs Station. Through support from the Group, the workshop enabled land managers to identify areas most at risk, priority sites, active sources of dispersal and options for various control methods.

Since 2010, \$160,000.00 of CFoC funds have been used to monitor and control the spread of *Acacia farnesiana* in the Peake Creek catchment. The Peake and Allandale stations are using traditional herbicide control on priority sites. Both properties are keen to continue with follow up work as the seasons permit. Evelyn Downs station being an organic station are trialling a number of approaches to control the spread of *Acacia farnesiana* including working towards improving landscape function.

Evelyn Downs fenced a section of drainage line adjoining Mt. Barry Station to create a priority control area between the two properties which will be regularly monitored for the downstream spread of seedlings.

The fenced buffered area has a twofold benefit: one, it is being used as a management control site and two, it is being used to help restore landscape function. The area was fenced to manage total grazing pressure and protect vegetation filters giving the riparian vegetation the opportunity to regenerate and compete with *Acacia farnesiana* seedlings. The riparian vegetation will assist to slow and spread the rate of overland water flow. This will calm the drainage line, help to reinstate natural landscape base levels and reduce the conditions favourable to the germination of *Acacia farnesiana*.

(Student). Grazing for biodiversity conservation and landscape function in NSW semi-arid rangelands

Sarah McDonald^{AD}, Nick Reid^A, Rhiannon Smith^A, Cathy Waters^B, John Hunter^C, David Tongway^A and Romina Rader^A

^ASchool of Environmental & Rural Science, University of New England,
Armidale NSW 2351

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

^CSchool of Behavioural, Cognitive and Social Sciences, University of New England,
Armidale NSW 2351

^DCorresponding author: E: smcdon28@myune.edu.au

KEYWORDS: conservation, biodiversity, grazing management, landscape function

Domestic livestock are often seen as a threat to biodiversity conservation. However, there is evidence to suggest that appropriately managed livestock grazing is compatible with maintaining conservation objectives and can play an important role in enhancing the biodiversity value of agricultural landscapes. Little research has been undertaken in the semi-arid rangelands of western New South Wales to understand this role.

My research explores the implications of commercial grazing management practices for achieving biodiversity conservation and landscape function objectives, and aims to determine the potential to integrate livestock production and conservation in NSW semi-arid rangelands. The project will also highlight trade-offs between conservation and production outcomes in a complex, rapidly changing, social-ecological environment.

Specific objectives of the project include to: (1) examine the impacts of innovative grazing management strategies on biodiversity and landscape function in comparison with traditional production and conservation areas; (2) determine if grazing management can be used to improve the conservation value of land and as a method of off-reserve conservation in the semi-arid rangelands of NSW; (3) investigate how these effects change over different spatial scales, land systems and seasonal conditions, and (4) identify relationships between biodiversity and landscape function in different semi-arid range types.

Floristic surveys, experiments, and landscape function analysis are being used across paired sites on properties throughout north-west NSW employing innovative grazing management, traditional production methods, and areas managed for conservation with little or no domestic livestock. The results of the project should assist natural resource management organisations, landholders and conservation groups with management tactics and strategies to achieve conservation and grazing outcomes in western NSW. In this presentation, preliminary results from initial floristic surveys will be presented, and future experiments will be discussed.

Land management on the Anangu Pitjantjatjara Yankunytjatjara Lands

Clint Taylor^A, Kate Holmes^B and Sam Doudle^C

Anangu Pitjantjatjara Yankunytjatjara Land Management,
PMB 227, Umuwa via Alice Springs, NT 0872

^AWatarru Indigenous Protected Area
(IPA) Coordinator,
E: clint.taylor@anangu.com.au, Ph: 08 8954 8171

^BWalalkara IPA Coordinator

^CAPY Ecologist

KEYWORDS: APY, threatened species, fire, buffel grass, South Australia, IPA

The Anangu Pitjantjatjara Yankunytjatjara (APY) lands are located in the far north-west corner of South Australia covering approximately 10 million hectares. Approximately 70% of this area is managed by the APY Land Management team under 3 major funded programs: Indigenous Protected Areas; Women's Land Management; and Black-Flanked Rock Wallabies. The three key natural resource management issues common to all programs are threatened fauna, fire management and Buffel Grass control.

There are three APY threatened fauna flagship species: Nganamara or Malleefowl (*Leipoa ocellata*); Warru or Black-Flanked Rock Wallaby (*Petrogale lateralis*); and the Tjakura or Great Desert Skink (*Egernia kintorei*). Each of these species historically had wider distributions and higher abundance throughout the APY lands however all have contracted due to feral predation and changed land management practices. APY Land Management has programs in place to monitor and manage the known remnant populations.

Traditional landscape patch burning practices have declined since traditional owners have become more centralised into township living. As a result fuel loads have increased and wildfires have caused significant landscape changes across the APY lands. APY Land Management is working with government, ecological consultants and Traditional Owners to better understand the fire regimes across the landscape and combine the traditional and modern fire management techniques to make the landscape more resilient.

Buffel Grass has dramatically changed the landscape across the northern APY Lands where it was introduced to stabilise soils around communities in the 1980's. Buffel Grass has become a virtual monoculture in those areas where it was initially established and is aggressively invading plains, ranges and sand dune country. The APY Land Management Team is working with the SA Buffel Grass Taskforce and AWNRM trialling chemical control options, mapping distribution and abundance and developing management plans to slow the spread of into new areas and reduce the impact at culturally significant sites.

Teaching the Word – “Waterponding” and “Waterspreading” – Aus Aid style

Ray Thompson^A and Prasanthi Sooriyakumar^B

^ACentral West Local Land Services,
PO Box 45 Nyngan, New South Wales 2825 Australia.
E: ray.thompson@lls.nsw.gov.au, Ph: 02 6831 1502, M: Mobile: 0428 697 428

^BSchool of Geography, Planning and Environmental Management,
The University of Queensland,
St. Lucia Queensland 4072 Australia.
E: prasanthi.sooriyakumar@outlook.com

KEYWORDS: waterponding, Aus Aid, African trainees, training, teaching, rehabilitation

A joint three year Aus Aid African training partnership between University of New England Armidale and Central West Catchment Management Authority Nyngan saw 79 Aus Aid African trainees from 29 African countries trained in the waterponding and waterspreading rangeland rehabilitation technique.

METHOD:

This paper will highlight the training methods used in the intense hands on teaching / training, so the Aus Aid African trainees could return to Africa and be able to develop / carryout the survey and construction methods of both waterponding and waterspreading rangeland rehabilitation techniques in their own country.

DISCUSSION:

The theory can be taught in the class room but to put it straight into practise and to come out and have the skills required at the end of the training to implement the rehabilitation methods back in their own country is a challenge in its self.

REFERENCE:

Thompson, R.F 2008. Waterponding: Reclamation technique for scalded duplex soils in western New South Wales rangelands. *Ecological Management & Restoration* Volume 9 No. 3 December

A collaborative approach to building community capacity and raising landscape function awareness across the rangelands:

Janet Walton^A and Camilla Osborn^B

^ANRM Officer Natural Resources SA Arid Lands,
E: janet.walton@sa.gov.au, Ph: 08 8672 3648

^BCentralian Land Management Association,
E: clma@clma.com.au, Ph: 08 8953 4230

KEYWORDS: landscape function, soil conservation, collaboration, workshops

Diesel, dust, dirt and noisy machinery topped with a dollop of tomato sauce on your bbq and you will be sure to get a reasonable turn out of attendees at your workshop. Add a spicy mix of land care and you'll be sure to scare most away. Not so with the South Australian-Northern Territory collaborative approach which successfully combined interpreting and understanding landscape function with soil conservation and track maintenance based on Ecosystem Management Understanding (EMU)TM.

Land managers, station hands and even earthmoving contractors have been willingly lining up to attend our workshops (and not just for the bbq!). The workshops ensured participants not only learnt about safe machinery operations and track maintenance but they were also nurtured and discreetly challenged to consider the environmental impact of their activity. Walking around drainage lines traversed by tracks quite simply highlighted issues associated with poor track alignment, vegetation (the stuff livestock eat) dehydration (death), exacerbated erosion and landscape dysfunction not to mention the expense associated with repeatedly "fixing" the same problem.

Ever asked yourself "Why after a rain is there more water on my road than out there on my countrywhere it should be growing more feed?"

On completion of the workshop participants had a better understanding of the causes of track problems not just the symptoms, and they came to terms with the fact that it is not the rain that does the damage to tracks it is the location, construction and maintenance. Understanding landscape function is crucial to how you manage your tracks and your country.

The interactive effects of burn intensity and mast-seeding on post-fire regeneration of slender mulga (*Acacia aptaneura*).

Boyd R. Wright^A and Alain F. Zuur^B

^ASchool of Environmental and Rural Science,
The University of New England, Armidale,
E: bwright4@une.edu.au, Ph: 0478 159 239

^BHighland Statistics, Ltd.,
9 St Clair Wynd. Newburgh AB41 6DZ, UK,
E: highstat@highstat.com

KEYWORDS: mast seeding, mulga, *Acacia aneura*, fire ecology, seed banks, seed predation

Members of the arid Australian mulga (*Acacia aneura*) complex are fire-sensitive masting shrubs (intermittent, synchronous producers of large seed crops) that are stimulated to mast by exceptionally high rainfall years. Such years also drive widespread wildfires in inland Australia, as high rainfall encourages large quantities of grassy fuels to accumulate. Despite this natural coupling of high seed yield with increased ecosystem flammability, little is known about the relevance of mast seeding for mulga post-fire seedling regeneration. Moreover, whilst the germination of mulga seeds is encouraged by heating, almost nothing is known about how fire intensity might interact with masting to influence recruitment after fire. In this poster, results are presented from: 1) a study that examined the effects of masting on mulga seed banks at Laycock's Sandplain, 200 km west of Alice Springs; and 2) a mensurative field experiment which examined the effects of fire intensity and mast seeding on mulga regeneration after fire. The seed bank study indicated that mast seed falls had a profound effect on seed banks, with a mast event in 2010 producing massive but short-lived pulses of seed in the upper soil layers. The field experiment indicated that when high intensity fires in 2011 coincided with elevated post-mast seed bank densities, there were increased levels of post-burn recruitment. Our research shows that: 1) mulga masting enhances resilience to burning by providing transient seed pulses during periods of high flammability (i.e. after heavy rainfalls); and 2) burn intensity interacts with masting to influence post-fire regeneration by heating the soil and stimulating the germination of buried mulga seeds. These findings have important implications for fire managers in inland Australia, because they introduce a previously unrecognized but vital factor (masting) in the regeneration ecology of one of Australia's most widespread woody plant complexes.

Keynote: Radicalising the rangelands: disruptive change or progressive policy?

Bruce W Walker AM FTSE

PO Box 3662, Alice Springs, NT 0871.

E: bruce.walker@icat.org.au,

M: 0418 812 119

In 'The Bush' Don Watson captures the nub of the rangelands dilemma. "Only about 15% of Australians now live outside the cities and the essentially suburban coastal corridor...Those coastal suburbs are home not to the descendants of drovers and Anzacs, but ambitious migrants from Asia and the Middle east, with no taste for rural life, and no appetite for sagas of male bonding in shearing sheds and creek beds under Banjo Patterson's everlasting stars."

Under pressure of globalisation and market economics the narrative of the rangelands has changed and with that the national interest in the rangelands has declined. Increasingly self-interest has over-powered national interest in the rangelands.

The traditional narrative relied on mining, pastoralism and tourism and the contest for land and resources between these sectors and Aboriginal interests. The early champions in each of these sectors were revered. Today these sectors are driven more by self interest and international investors than national interest. Today we do not have the recognition of names like Kidman or Flynn or Perkins. The rangelands are no longer in the hearts and minds of the nation.

Rangelands impinge to a degree on national security through the buffer of confidence their vast expanse provides to coastal communities. Rangelands also figure in the national conscience through the complexity of issues around 'the problem' of Aboriginal lifestyles as perceived by coastal communities. Yet topics that spark national interest in rangelands are hard to identify unless they relate to share dividends.

In this indifferent environment, will the rangelands benefit from grand national policy initiatives or from increasingly focused progressive policy?

On balance, this paper argues for a more disruptive and innovative radicalisation of the rangelands narrative to re-ignite national interest and national investment.

Conference Partners

The Conference Planning Committee wish to acknowledge and thank the following organisations for their sponsorship and assistance to enable the staging of the 18th Biennial Conference:



ALSO SUPPORTED BY



RioTinto



S. Kidman & Co Ltd



Santos



- Paspaley Bunnamagoo Estate Wines
- John A Taylor



**Australian Rangeland Society
18th Biennial Conference**

Alice Springs Northern Territory
12 - 16 April 2015

www.arsconference.com.au

