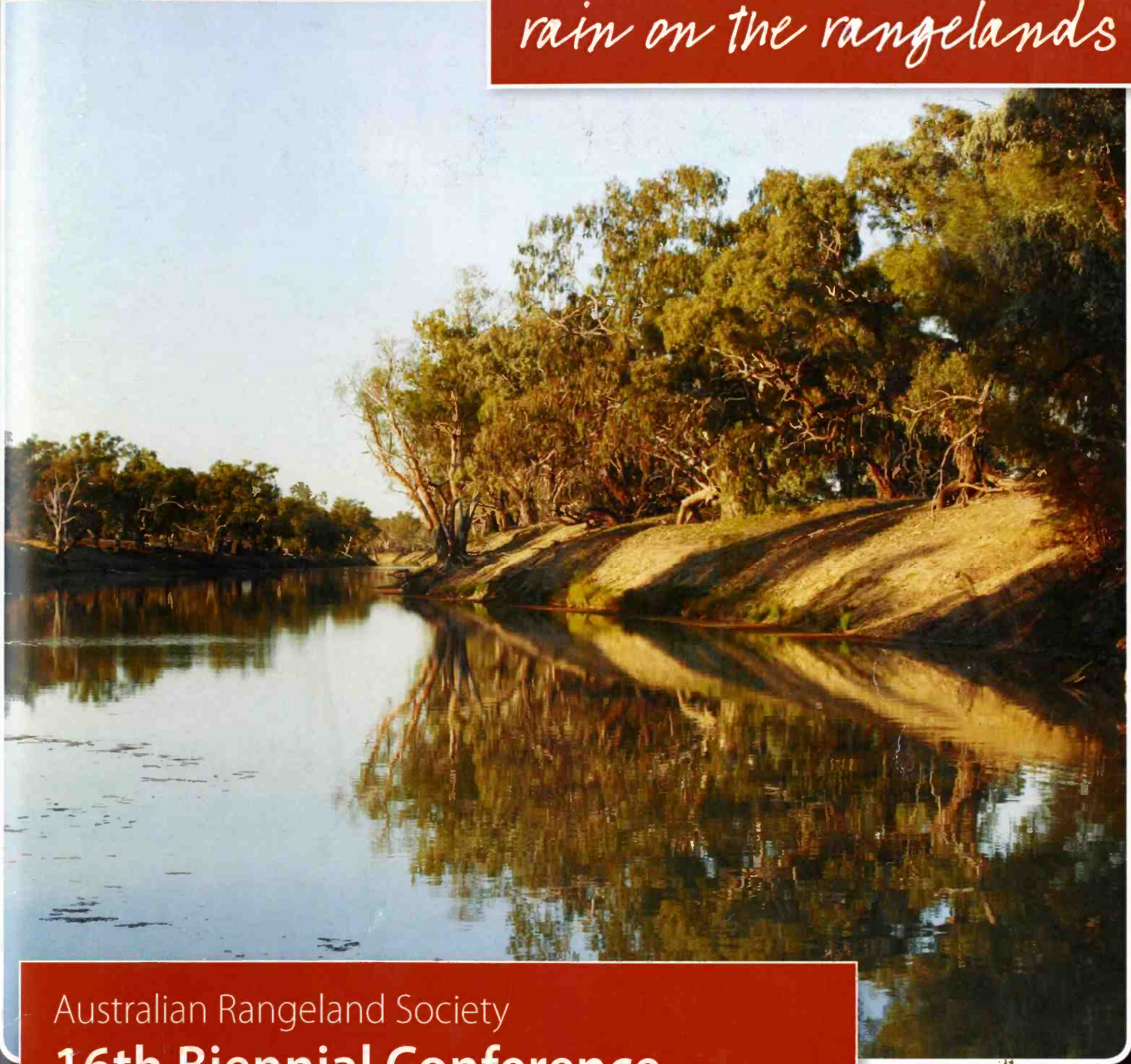


rain on the rangelands



Australian Rangeland Society

16th Biennial Conference

Bourke, New South Wales, 26 - 30 September 2010

Hosted by the Western Catchment Management Authority
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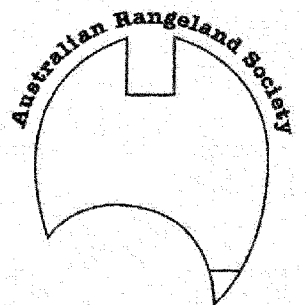
Published by the Australian Rangeland Society 16th Biennial
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Conference organised by Natalie Bramble Management

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Disclaimer: These papers have not been refereed by the Conference Program Committee. The content of each paper is the responsibility of its authors. The Committee has formatted all abstracts and papers to a common style.



FOREWORD

Welcome to Bourke and the 16th Biennial Conference of the Australian Rangeland Society. The Society is an independent and non-aligned association formed in 1974 to promote wider discussion of the natural resource management of Australia's rangelands. The biennial conference is the major public event of the Society. It is recognised as the key national forum for communication between researchers, policymakers, extension workers and the land management community on the issues facing the rangelands.

In 1893, poet Henry Lawson wrote "if you know Bourke, you know Australia". The Society has a tradition of running its conferences at locations actually within the rangelands, rather than in the larger population centres, in order to maintain its connection with the landscape. Bourke is an iconic location in the rangelands, closely linked to the history of the Darling River and pastoralism but providing contemporary insights into a range of natural resource management issues. What the town lacks in five-star accommodation, it makes up for in authenticity as a setting for the conference.

Bourke is situated at the meeting point of a diversity of landscapes including Mitchell grass plains, mulga woodlands and significant wetland systems. The management issues of these landscapes reflect those of the wider Australian rangelands. The town is therefore well-placed for a range of field tour options and the organising committee has chosen total grazing pressure management, the control of invasive native scrub, innovative grazing systems, enterprise-based conservation, river habitat restoration and Aboriginal heritage as issues for on-ground discussion (weather permitting).

The conference theme, "Rain in the Rangelands", was coined in the midst of prolonged drought and declining flows in inland rivers. The organising committee envisaged a fairly broad exploration of the issues associated with water use in rangeland environments but with a central session focusing on the Murray Darling Basin linking to the Darling River in Bourke. With the change of seasonal circumstances across many rangeland areas in 2010, "rain on the rangelands" is now a literal reality, but the issues remain pertinent and we trust that you will enjoy the discussion.

A challenge for the Society has always been the tempering of rangeland science with practical application. The financial investment and adaptive management of progressive landholders is the primary driver to improving on-ground natural resource management throughout most of inland Australia. For this 16th Biennial Conference we have allocated the first day of proceedings to the practitioners of rangeland science on both pastoral and Aboriginal lands. Landholder representatives from four states and the Northern Territory will present their perspectives on managing land and implementing available science. We look forward to the case studies and practitioner viewpoints to be presented in Sessions One and Two.

The conference has attracted forty eight oral presentations and a further thirty eight posters. The organising committee thanks all authors for their efforts in preparing and presenting their material as this is the substance of the conference. The papers reflect the present state of natural resource management in the rangelands and provide an excellent basis for discussion and networking. With the permission of authors, all papers will be accessible on the Australian Rangeland Society website.

The Australian Rangeland Society is a not-for-profit organisation and is reliant on the generous support of our sponsors in financing aspects of the conference. Their contribution to this conference has been substantial and we sincerely thank them for their commitment to the event. Sponsorship funds have been used to minimise registration costs and enhance conference content and facilities.

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The 16th Biennial Conference has been the result of the consistent effort of a local organising committee based in Bourke, a small editorial team and a steering committee overseeing program matters. Thank you for the contribution of all players. We are also indebted to the enthusiasm of the event organiser, Natalie Bramble Management, in tackling the task of bringing the conference together.




Russell Grant
Chair
Conference Organising Committee

Conference Program

Sunday 26 September



Registration: Old Lands Office	3.00pm onwards	Natalie Bramble Management
Civic Reception: Old Lands Office	6.30pm - 8.30pm	Drinks and <i>hors d'oeuvres</i>
Official Welcome	7.00pm	Mayor Andrew Lewis, Geoff Wise - Bourke Shire Council, Rory Treweeke - Western CMA

Monday 27 September



Registration desk opens: Bourke Multipurpose Centre	7.30am	Natalie Bramble Management
Pre-Conference Field Tours Sponsors: Department Environment, Water, Heritage and Art, Natural Heritage Trust and Western Catchment Management Authority	8.00am	Field tours depart  
	4.00pm - 5.00pm	Field tours return  
Book launch: "Desert Channels: The Impulse to Conserve"	7.00pm	Mandy Martin
Social event: BBQ dinner: bank of the Darling River, Bourke Wharf area. Sponsor: Central West Catchment Management Authority	6.30pm - 9.30pm	Master of Ceremonies: Andrew Hull  






Tuesday 28 September

Registration desk opens: Bourke Multipurpose Centre	7.30am	Natalie Bramble Management
Day One: Rain on the Rangelands - The Practitioner's View		
Conference Opening	8.30am	Welcome to Conference: MC Andrew Hull
	8.35am	Welcome to Country: Phil Sullivan & dancers
	8.45am	Official Opening: The Hon. Michael Veitch MLC
Session One: Rain-driven production systems Sponsor: Land and Property Management Authority 	9.00am	Session Chair: Adrian Harte LPMA
	9.05am	Keynote Address: Guy Fitzhardinge Woody weeds, wabbits and weconstruction
	9.25am	Douglass Lillecrapp A Landholders perspective on land restoration on Todmorden Station, Oodnadatta
	9.45am	David Pollock Catchment restoration bears fruit on Wooleen Station, Murchison, WA
	10.05am	Robert Bartlett Conservation and production in harmony on the Paroo Floodplain
10.25am Morning Tea		
Session One: continued	10.55am	Robyn Cadzow Is rehabilitation profitable?
	11.15am	Graham Finlayson Making better use of grazing charts in rangeland grazing enterprises
	11.35am	Ben Forsyth Strategic, innovative and integrated interventions to calm, stabilise and conserve key productive landscapes in the upper Gascoyne River Catchment, WA



Session One: continued	11.55am	Deb Kaluder	Regenerating Naree through changing management strategies
	12.15pm	Andrew Schmidt	A journey down the Warrego
	12.35pm	Kevin Mitchell	Waterspreading to restore native grasslands
	12.55pm	Lunch	
		Soapbox Session: Facilitated by Ken Harrison	
Session Two: Aboriginal land management Sponsor: NSW Department of Environment, Climate Change and Water 	1.40pm	Session Chair: Nerida Green DECCW	
	1.45pm	Keynote Address: Sam Jeffries - Indigenous Land Corporation	People, Land, Opportunity - Marrying Indigenous land management and economic development in the rangelands
	2.05pm	Blackie Gordon	Through our eyes: Aboriginal knowledge, past present future
	2.25pm	Karel Eringa	Beyond Black Stumps: fostering improved ecological and economic outcomes on Aboriginal held pastoral stations
	2.45pm	Dharriwaa Elders Group	Aboriginal representation and participation in caring for country
	3.05pm	Keynote Address: Jan Ferguson - CRC for Remote Economic Participation	A journey into the future of the Australian rangelands
	3.25pm	Afternoon Tea	
Structured Poster Viewing Sponsor: Central West Catchment Management Authority 	3.45pm - 5.15pm	Facilitator: TBA	
	7pm	Free evening, Bourke venues	

Wednesday 29 September

Registration desk opens: Bourke Multipurpose Centre	8.00am	Natalie Bramble Management	
Day Two: Rain on the Rangelands - The Rangeland Basins: Wetlands and Drylands			
	8.30am	Session Chair: Mark King - LMD CMA	
	8.35am	Keynote Address: Mr Jason Alexandra - Murray Darling Basin Authority	Rivers and the MDB rangelands
Session Three: Issues of the Murray Darling Basin Sponsor: Lower Murray Darling CMA 	8.55am	Gil Hogendyk	Restoration of semi-arid zone wetlands: the Macquarie Marshes
	9.15am	Gresley Wakelin-King	Rivers are more than just water: Landscape, ecology and geomorphology in rangeland management
	9.35am	Mark Stafford Smith	Managing MDB livestock production systems in a variable and changing climate: challenges and opportunities
	9.55am	Graham Marshall	Natural resources governance for the drylands of the Murray-Darling Basin
	10.15am	Morning Tea	
Session Four: The Big Picture - Basin Issues across the Rangelands Sponsor: Desert Channels Queensland 	10.45am	Session Chair: Mike Chuk - DCQ	
	10.50am	Keynote Address: Dr Richard Kingsford - University of NSW	What if anything have we learnt about sustainable management of inland river systems?
	11.10am	Robert Hassett	Guidelines for determining lease land condition - Delbessie Agreement (State Rural Leasehold Land Strategy)

Session Four: continued	11.30am	Eleanor Dennis	Feral camels in the Australian rangelands
	11.50am	Greg Brennan	Pastoralists in the arid shrublands of Western Australia name the 'elephant in the room'
	12.10pm	Kate Forrest	Putting our heads together
	12.30pm	Lunch	
		Soapbox Session: Facilitated by Ken Harrison	
Session Four: continued	1.15pm	Session Chair: Cathy Waters - DI&I	
	1.20pm	Keynote Address: Dr Joel Brown - USDA NRCS	How do we communicate the value of rangeland management?
	1.40pm	Mike Chuk	Invasive cacti - a threat to Australia's Rangelands
	2.00pm	Erlina Compton	Ecological and social resilience in Western NSW: Insight from 7 years of Enterprise Based Conservation
	2.20pm	Caroline Harris	Environmental effect on aquifers of coal-seam-gas extraction in the Surat Basin
	2.40pm	Wal Whalley	The impact of Lippia on the Social-Ecological System of the Murray-Darling Basin in north western New South Wales
	3.00pm	Afternoon Tea	
Session Five: Young scientist/student presentations Sponsor: Rangelands Australia 	3.20pm	Session Chair: Dave Eldridge - DECCW	
	3.25pm	Keynote Address: John Taylor - Rangelands Australia	Knowledge and skills in the rangelands - a crisis?
	3.40pm	Phoebe Barnes	Using active optical sensing of biomass to investigate the effect of scattered trees on native perennial pastures
	3.50pm	Alan Kwok	Shrub-resident arthropods in an <i>Eremophila</i> and <i>Senna</i> - dominated shrubland
	4.00pm	Giregon Olupot	Can root biomass of grasses in NSW be predicted from shoot biomass yields?
	4.10pm	Jonathon Moss	Estimating the cost of protecting biodiversity on privately managed properties in the Australian Rangelands
	4.20pm	Samantha Travers	Post-fire litter accumulation under mallee canopies in south-western NSW
	4.40pm	Joab Wilson	Effects of artificial watering points on rangeland bird communities
	4.30pm	Summary	
Structured Poster Viewing Sponsor: Central West Catchment Management Authority	5.00pm - 5.30pm	Facilitator: TBA	 
Conference Dinner: Back O' Bourke Centre Sponsor: Murray Darling Basin Authority	7.00pm	MC: Mr Geoff Wise, light entertainment	 

Thursday 30 September

Registration desk opens: Bourke Multipurpose Centre	8.00am	Natalie Bramble Management	
Australian Rangeland Society General Meeting 8.00am - 9.00am	8.45am	Daryl Green	Ode to Dick Condon
	8.50am	Dr Gabriel Oliva	IX International Rangeland Congress - IRC2011 Rosario, Argentina
Day Three: Rain on the Rangelands - A Variable Resource			
	9.00am	Session Chair: Andrew Freeman - MLA	
Session 6: Managing the trade-offs Sponsor: Meat and Livestock Australia 	9.05am	Keynote Address: Dr Mark Stafford Smith - CSIRO	Making a future for the rangelands: trade-offs at multiple scales
	9.25am	Mark Kossler	Resolving the manager's dilemma: Utilising an integrated approach to attain complementary objectives of conservation and cash flow
	9.45am	Sheldon Attwood	Pulling it all together: A system for sustainable stewardship, sound investment and stable communities
	10.05am	Deb Agnew	A framework for the management of feral goats in semi-arid SA
	10.25am	Morning Tea	
Session 7: Rangeland resilience and tipping points Sponsor: Meat and Livestock Australia 	11.05am	Session Chair: Andrew Freeman - MLA	
	11.10am	Keynote Address: Dr Ian Watson - CSIRO	Transitions across thresholds in Western Australian grazed rangelands
	11.30am	Gary Bastin	Reporting change in landscape function using the Queensland ground cover index
	11.50am	Dionne Walsh	Can sustainable pasture utilisation rates be derived from commercial paddock data in the Northern Territory?
	12.10pm	Martin Westbrooke	Biodiversity impacts of ground tank closure in southeast Australian rangelands
	12.30pm	Lunch	
		Soapbox Session: Facilitated by Ken Harrison	
Session 7: continued	1.15pm	Alan Lauder	Rest after rainfall: The carbon grazing story
	1.35pm	Gregg Simonds	Quantum innovation in measuring, monitoring and managing ecological function on large scales reliably and affordably
	1.55pm	Joe Scanlon	The Northern Grazing Systems Project: Estimating safe stocking rate
	2.15pm	Peter O'Reagain	Long-term profitability and sustainability of grazing strategies in a tropical savanna in north Queensland
Session 8: Conference summation and close	2.35pm	Session Chair: John Taylor, President ARS	
	2.40pm	Panel: Ron Hacker Joel Brown	Summation
	3.00pm - 3.30pm	Afternoon tea and departure	

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The risky business of designing land tenure policy in the Gobi Desert

Addison, J.^{1,2}, Friedel, M.¹, Davies, J.¹, Tiver, F.³ and Bastin, G.¹

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Keywords: variability; pastoral; climate

Abstract

Pastoralists need to manage the feed gap risk that climatic/forage resource variability presents. We use the PHYGROW model to better understand interactions between this variability and the effectiveness of a geographically fixed pastoral community management area (CMA) in the Gobi Desert. The model shows significant intra- and inter-annual forage variability within sites, as well as significant variation between sites. Interviews with 9-Erdene members, and others, indicate that 'rule breaking' through departure of pastoralists and livestock from the area during frequent poor forage years is common, although other CMA institutions that maximise livestock body condition have been maintained. There is significant risk that designing and adequately policing geographically fixed pastoral systems at this scale will facilitate overgrazing and reduce livelihoods. The provision of financial and in-kind support that provides more diverse, affordable and accessible risk management options to pastoralists may be more effective at promoting good rangeland condition than further effort to closely define the boundaries of household grazing lands.

A framework for the management of feral goats in semi-arid South Australia

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²PO Box 1828, Port Augusta, SA 5700

Keywords: unmanaged goats; collaboration; integrated management

Abstract

An environment modified for rangelands sheep farming has created conditions where feral goat (*Capra hircus*) populations can escalate if unchecked. The impacts of feral goats on native vegetation, fauna and land condition result from their unmanaged contribution to total grazing pressure. In South Australia there is a legislative requirement for control of feral goats, however this is contradicted by significant motivators to retain feral goat herds as an optional resource.

The SA Arid Lands Natural Resources Management Board sought to address the complex problem by developing a framework for management. To support the framework, funding for feral goat removal assistance was obtained. The removal program successfully reduced the feral goat population in the South Australian rangelands, however at only half the predicted natural annual rate of increase. Importantly, the project demonstrated that integrated control, using a combination of methods, could be cost neutral to a landholder.

To implement the framework completely, high priority removal areas will need to be defined where intensive feral goat removal activity can occur. To support the project and provide information, monitoring of feral goat populations and vegetation condition in these areas should be commenced. To ensure actions are cross-regional in scale a taskforce is proposed. The involvement of community in developing district scale population reduction targets for removal will be critical. There will also need to be an extensive education and awareness program in place to convey the common vision of more resilient landscapes.

Evaluating short term cropping for restoration of native perennial grasslands in western NSW

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Keywords: INS; restoration; grasslands; ground cover

Abstract

Invasive Native Scrub (INS) is a major problem in the pastoral lands of western NSW. The objective of the project was to test the hypothesis that native perennial grasslands do regenerate in areas that have been cropped following removal of INS. A total of 30 paddocks that had been cropped during the last 20 years were selected. Vegetation surveys were conducted in each paddock in March/April 2008. Results indicated that ground cover, native perennial grass cover and standing dry matter were highest under light/rotationally grazed conditions and availability of soil seed did not appear to be a limiting factor. We conclude that short term cropping can be used successfully to remove INS and restore native perennial grasses if post-cropping grazing management is appropriate.

Rivers and the Murray Darling Basin rangelands

Alexandra, J.

Murray Darling Basin Authority

Keywords: rivers; water reform; Murray Darling Basin

Abstract

A significant proportion of the Murray Darling Basin (MDB) is in the semi arid climatic zone with pastoralism a dominant land-use. Snaking through these rangelands are many thousands of kilometres of "flat, lazy" rivers and creeks, which occasionally spread floodwaters over vast areas. These floods nourish floodplains, woodlands and wetlands, bringing water and with it life to the inland. During the past summer (2009-10), widespread rains resulted in extensive flooding in the Balonne, Nebine, Paroo and Warrego and Barwon Darling systems. Rangeland and riverine management and conservation share many challenges. The Basin's rangelands and rivers share their climate driven, drought-flood, and boom-bust cycles that span temporal scales of decades or generations. They also operate on large spatial scales and share the need for both policies and people, committed to long term, integrated and adaptive NRM informed by long term monitoring and systematic evaluation. This paper briefly profiles the importance of these riverine systems and provides an overview of the policy and planning processes aimed at ensuring their long-term sustainable management.

Competing models for conservation worldwide: why rangeland stewardship requires private participation & attention to cash flow

Atwood, S. and McCoy, N.

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Keywords: conservation; efficiency; models

Abstract

Land conservation is typically entrusted either to government agencies or non-governmental organizations (NGOs) who rely on external funding sources (e.g. taxpayer dollars, donations) to conduct conservation. In recent years, economic conditions have demonstrated that charitable giving by individuals and non-profit endowments is substantially reduced during periods of recession and stock market declines (Grunewald, 2003). Furthermore, public resource allocations are also susceptible to economic declines, shifting political agendas, natural disasters, and dynamic world events. Such instability undermines the long-term outlook for conservation dependent on external funding. This presentation examines three conservation archetypes (Preserves, Easements, and Revenue-Generating Properties) using conventional cost-benefit and cost-effectiveness methodology to support the traditional practice of resource allocation by the industry before exposing the fatal flaw in this thinking that overlooks the most important factor of all: actual conservation outcomes across space and time.

Using active optical sensing of biomass to investigate the effect of scattered trees on native perennial pastures

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2 NSW Department of Environment, Climate Change and Water (PO Box U221), UNE, Armidale 2351

Keywords: remote sensing; green pasture biomass; NDVI

Abstract

Trees scattered throughout paddocks have long been considered keystone structures in agricultural landscapes, however little is known about how they actually influence pasture growth. Assessing pasture biomass with sufficient spatial detail requires a cost and time-effective sensor. In this study we test whether an active optical sensor, utilising red and near-infrared wavebands to derive the normalised difference vegetation index (NDVI), can be used as a surrogate measure of photosynthetically active biomass (PAB) associated with native perennial grasses around scattered trees in grazing paddocks. Pasture cuts were acquired to create and test NDVI-biomass calibrations in the vicinity of 12 scattered trees across a range of species and soil parent materials. Observed regressions beneath the tree between NDVI and PAB were statistically significant although R^2 were generally less than 0.33. We believe that this result is largely due to the variable composition of the native pastures (live and dead fraction, physical structure). Overall, no significant difference was found in PAB with distance from the tree, meaning that under the tree there was similar pasture biomass to the open paddock.

Conservation and production in harmony on the Paroo floodplain

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Abstract

My family and I own/manage approximately 85000ha of pastoral leasehold land on the Paroo River 50kms south of the small village of Wanaaring in western New South Wales. Our enterprise is purely grazing based. Braford cattle, merino sheep and harvesting feral goats all play their part in economic returns. The success of our business has been a result of management practices passed down over four generations living and working on the Darling and Paroo overflow country. The Paroo River and its natural flows are a vital part of our enterprise. The floodplain and wetland systems of this river remain an outstanding example of viable production being achieved while maintaining the conservation values of the Paroo. The Paroo River remains a vital breeding ground for waterbirds and aquatic species native to these areas. While feral animals such as pigs, foxes and feral goats do pose a threat to native flora and fauna they can be controlled. The biggest threat to the Paroo basin is, of course, the development of irrigation or floodplain water harvesting. However, under careful management the Paroo can remain a magnificent native habitat while still producing food and fibre for many generations into the future.

Reporting change in landscape function using the Queensland ground cover index

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Keywords: dysfunction; regional reporting; remote sensing; Wambiana grazing trial

Abstract

A ground cover index (GCI) derived from Landsat TM data is available for Queensland since 1986. It provides a potentially robust means for reporting change in landscape function to the Australian Collaborative Rangelands Information System (ACRIS). We report early progress in developing such an index based on the temporal behaviour of pixel GCI values. Pixels within paddocks in the Wambiana grazing trial were classified as notionally 'functional' or 'dysfunctional' based on a specified deviation in ground cover from their longer-term temporal mean. This produced distinct spatial patterning of 'dysfunctional' areas for some grazing treatments in drier years. The proportional area of this 'dysfunctional' class within paddocks and vegetation types was significantly correlated with estimated ground cover. Further methodological development will relate the currently developed temporal deviations in pixel GCI to that occurring in the surrounding neighbourhood. When a suitably robust method for indicating landscape function from GCI is available, we will increase the scale of analysis to sub-bioregions so as to report change in landscape function for Queensland's rangelands to ACRIS.

Monitoring and managing the use of riparian areas by cattle

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Keywords: environmental protection, GPS, automated animal control

Abstract

The ability to modify the distribution of grazing livestock is a common desire among farmers, either to protect sensitive areas or to more closely match stocking rate with carrying capacity. Virtual fencing (VF) technology offers an alternative method of controlling both where and when animals graze without the need for physical barriers, which are costly to erect and maintain, particularly along riparian areas. The potential for automated animal control collars to reduce the impact of cattle on riparian areas was evaluated. A replicated experiment was run for up to three months using four groups of ten cattle. Each group was allocated to a separate 24 ha paddock. Automated animal control collars utilise GPS to monitor position and provide cue (audio) and control (mild electric shock) stimuli to deter animals from entering an exclusion zone.

When the cattle were familiar with the paddock, a duty cycled GPS collar was fitted to each steer for two weeks and background-monitoring data collected. Once the background data had been collected, the coordinates of the exclusion zone were sent to the collars to start the control phase of the experiment that ran a further two weeks. Cattle were observed from a distance regularly and had access to ad-libitum grazed forage and trough water throughout the experiment. During the monitoring phase of the experiment cattle spent 6% of their time in the exclusion zone, but less than 0.01% of their time in the exclusion zone after the virtual fence was enabled.

Pastoralists in the arid shrublands of Western Australia name the 'elephant in the room'

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Keywords: kangaroos; grazing; shrublands

Abstract

Pastoralists across five shires in the West Australian (WA) arid shrublands have designed a project to determine how to cost-effectively regenerate the productive capacity of their land. The project is focused on individual paddocks or management units to develop improved methods for controlling total grazing pressure (with an initial focus on kangaroos) and to strategically intervene in catchments to reduce the soil erosion and land dehydration processes. They acknowledge that kangaroo control is a nation-wide challenge which has a history of intractability and that it meets all the criteria of a 'wicked problem'. They also acknowledge that wicked problems require alternative problem solving methods but are disappointed that State and Commonwealth governments show disinterest in sharing the load of addressing this problem. The pastoralists are committed to contributing local knowledge for the development of necessary enabling legislation and they recognise that the multiple and conflicting interest groups must be engaged with their challenge if they are to achieve enduring solutions.

A Risk to Groundwater from Coal Seam Gas Extraction in the Surat Basin

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Keywords: coal seam; underground water; traditional agriculture

Abstract

The potential exists for land use conflict to arise between coal seam gas mining and traditional agriculture in the Surat Basin in Southern Queensland. Farming and grazing enterprises, businesses and towns in the region are largely dependent on the underground aquifers for their water supply. The process of extracting the gas from the coal seam results in the withdrawal of large quantities of water from the aquifers which underlie the basin and form part of the Great Artesian Basin water resource. Under State Government legislation the Coal Seam Gas Companies are allowed unlimited take of underground water while extraction of water for other users is controlled by the State Government. There is concern that due to connectivity between the coal seam and the aquifers that the dewatering during the gas extraction process is unsustainable. The risk of connectivity may be increased through the fracturing process used to enhance the release of the gas from the coal seam. It appears that the legislation governing the Coal Seam Gas industry does not protect the underground aquifers and that the Queensland Government has not followed the Precautionary Principle for sustainable development of this industry.

Biotic and abiotic thresholds to recovery of degraded spring wetland communities

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Keywords: grazing; soil seedbank; novel ecosystems

Abstract

Human impacts have dramatically altered the structure and composition of many communities often resulting in new or novel states that are difficult (and potentially impossible) to reverse. New ecosystem states may be irreversible once biotic and abiotic thresholds have been crossed. Artesian spring wetlands are rare vegetation communities restricted to areas of natural discharge from the Great Artesian Basin, south eastern Australia. Human impacts on disturbance regimes and hydrology have dramatically altered the structure and ecosystem function of these wetland communities. We explore the recovery potential of these communities by examining biotic and abiotic constraints to restoration. Abiotic thresholds to restoring ecosystem function are loss of ground water discharge, excavation and soil salinisation. Biotic thresholds include introduced stock grazing and propagule supply. The soil seedbank of the springs was examined to determine propagule availability, species endemism, and proportion of introduced vascular plant species. We found the biotic structure of these communities constrained by limited propagule availability in the soil seedbank, with species richness relatively low in all spring wetlands and no evidence of an endemic flora. We examined the response of the plant communities to the total removal of grazing, and found recovery dependent on site characteristics, water and pre-existing vegetative species. We have suggested a state-and-transition approach that considers these abiotic and biotic constraints to enable land managers to assess transitions and thresholds between the main spring states. Rehabilitation of these degraded vegetation communities may require active management, including return of discharge water, to overcome some hard-to-reverse thresholds.

Is rehabilitation profitable?

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Keywords: ponding; rehabilitation; cost

Abstract

Have you ever sat and watched what cattle eat in about half an hour? Have you counted the number of species of plants they prefer to eat? To be productive, cattle should have a variety of nutritious and palatable pasture. To have that variety of plants, pastures have to be receptive to the moisture and nutrients to convert CO₂ into the energy required to grow and produce enough seed and leaf matter. Bare soil is vulnerable to bombardment by raindrops (when it does rain) and the soil is pulverised into smaller particles which in turn seal the soil surface, causing more water to run off down the creek instead of soaking into the soil profile. Hardset soils affect seedling emergence and if we can ensure there are plants or plant residues like butts of the perennial pasture species, then we are helping to slow the evaporation rate from the soil and increase the seedling's chance of establishment. Picture a particular piece of country and what it looked like 20 – 30 – 40 years ago – has it changed? What is different? If there are gullies there, were they as big as they are now? Think of all the grass that may have been there that may not be now. How many cattle would that have fed? There are always arguments for and against rehabilitating soil that has started to shift with the wind or water or scalded country.

Engaging communities for research on contentious issues

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Keywords: community engagement; invasive native scrub; research

Abstract

In 2006, the Central West and Western Catchment Management Authorities (CMAs) began a program of research in collaboration with the Department of Environment, Climate Change and Water (DECCW), landholders and other partners on the serious issue of invasive native scrub (INS, also known as woody weeds). Nine research projects were implemented with the support of research organisations. The research projects relied heavily on the support of landholders across the Cobar Penneplain. However, native vegetation management and INS have a long and turbulent history in parts of central west and western NSW. The INS research program faced barriers of distrust of government, community cynicism and lack of faith in research processes. Through open communication, transparent processes and a program of community engagement, the program has successfully engaged landholders to implement a series of research projects.

Invasive cacti – a threat to the rangelands of Australia

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Keywords: cacti; invasive; rangelands; Australia

Abstract

Invasive cacti have been identified by the natural resource management community as a major threat to the biodiversity and primary production values of the rangelands of Australia. A number of species of cacti (principally members of the *Opuntia* and *Cylindropuntia*) have serious infestations in semi arid and arid areas of all mainland states. These weeds have proven difficult and very costly to control using chemicals and currently have few effective biological controls. The Rangelands NRM Alliance has identified the threat that invasive cacti pose and has supported the formation of the Australian Invasive Cacti Network. The network objective is to raise awareness of the threats posed by this group of weeds and provides a conduit for the exchange of information on taxonomy, biology and best practice control techniques.

Engaging landholders in managing areas of high conservation value in the Western Catchment

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Keywords: conservation; landholders; engaging

Abstract

Engaging landholders in the Western NSW rangelands in previously believed "green" conservation programs, has been limited in the past. The Western Catchment Management Authority's High Conservation Value financial incentive program is working to change this. By building relationships with landholders through a partnership approach led by enthusiastic district staff, an increasing number of landholders are participating in conservation management on their properties. Providing financial incentives for conservation outcomes has led to over 35 properties involved encompassing over 21 000 hectares of sites. Places of ecological and cultural importance are being added to the program, which from a slow beginning is now gaining momentum and diversity in the types of landholders engaged and sites included.

Ecological and social resilience in Western NSW: Insight from seven years of enterprise based conservation

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Keywords: conservation, community, resilience

Abstract

Two market-based instruments, namely Enterprise Based Conservation, have been operating in western NSW since 2003. These programs provide a cost-effective alternative to the national park estate, with over 130,000 hectares across 18 sites being managed for conservation outcomes for approximately \$2 per hectare per year. Ecological resilience is enhanced through a reduction in total grazing pressure, and through the control of weeds and pest animals. Providing an alternative income to traditional rain-based products improves the economic resilience of participating landholders. Maintaining people in the rural landscape allows rural communities and their services to continue to be supported, sustaining the social resilience of the often diminishing communities in rangeland areas.

Lynray Quandong (*Santalum acuminatum*) Orchard Establishment

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Keywords: *Santalum acuminatum*; quandong; Australian native foods

Abstract

This paper has collated information obtained from existing quandong (*Santalum acuminatum*) growers and literature on factors to consider when establishing a small quandong orchard. The quandong orchard was established on a grazing property in the semi-arid rangelands of NSW as a potential alternative source of income. It highlights that industry growers have and will continue to, depend on their own research for development. Individual seedlings rather than grafted genotypes have been used in this orchard. The orchard is designed to compare growth rates of quandong on a selection of semi-arid host species. The orchard could potentially be used as a source of genetic material for future breeding.

Conservation Partners for the National Reserve System Program: a Western NSW focus

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Keywords: Western NSW; conservation; protected areas

Abstract

This project is a Caring for Our Country initiative between the Australian and New South Wales Governments which aims to increase the involvement of private and other public landholders in the National Reserve System (NRS) through voluntary establishment of Conservation Agreements over places of high natural and cultural heritage conservation value. The project seeks to encourage all private and other public landholders with high conservation value areas on their properties to contribute to the continuing development of a 'Comprehensive, Adequate and Representative' (CAR) network of protected areas across NSW. The goal is to conserve examples of the full range of ecosystems and which shows Australia's great diversity of wildlife and unique natural heritage.

Currently only 8% of the total land area of NSW is protected in public national parks and reserves. This means that 92% of the land area of the state is on private and other public lands. There is an opportunity for private and other public landholders to protect significant natural and cultural heritage on their land as part of a new approach to include landholders with Conservation Agreement covenants in the NRS. The focus of effort is in bio-regions currently under-represented in protected areas in western areas of the state with less than 5% of their natural areas remaining, and strengthening connectivity and resilience.

Managing MDB livestock production systems in a variable and changing climate: challenges and opportunities

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Keywords: Murray Darling Basin, climate change, adaptation

Abstract

The key biophysical impacts associated with projected climate change in the Murray Darling Basin (MDB) include - declines in pasture productivity, reduced forage quality, livestock heat stress, greater problems with some pests and weeds, more frequent droughts, more intense rainfall events, and greater risks of soil degradation. The most arid and least productive rangelands in the MDB region may be the most severely impacted by climate change, while the more productive eastern and northern grazing lands in the MDB region may provide some opportunities for slight increases in production. In order to continue to thrive in the future, livestock industries need to anticipate these changes, be prepared for uncertainty, and develop adaptation strategies now. While climate change will have direct effects on livestock, the dominant influences on grazing enterprises in the MDB region will be through changes in plant growth and the timing, quantity and quality of forage availability. Climate change will involve a complex mix of responses to (1) rising atmospheric carbon dioxide (CO₂) levels, (2) rising temperatures, (3) changes in rainfall and other weather factors, and (4) broader issues related to how people collectively and individually respond to these changes. Enhancing the ability of individuals to respond to a changing climate will occur through building adaptive capacity. In particular this will require (1) the availability of effective adaptation options, (2) capability of enterprise managers to implement these options and (3) a policy and institutional environment that promotes the development, evaluation and adoption of effective adaptation strategies.

The Australian Pest Animal Strategy

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Keywords: pest; animal; management

Abstract

The Australian rangelands are inhabited by a variety of vertebrate pest animals including rabbits, foxes, and wild dogs, and feral camels, goats, pigs and cats. These pests cause environmental damage through their predatory and browsing activities and economic impacts through forage and stock losses, damage to infrastructure and associated management costs. The Australian Pest Animal Strategy (APAS) was recently developed by the national Vertebrate Pests Committee (VPC), and now provides a framework plan that has been endorsed by all Australian governments. It sets out how the governments will work with each other, and with business, industry and the community to manage the issues and problems associated with vertebrate pest animals in Australia. In its most basic terms, the APAS aims to help prevent the introduction and spread of new pest animals, manage the impact of those that are already established, and assist the cooperation between jurisdictions and agencies that is required to achieve these goals. The APAS also describes a series of principles, objectives and actions that are intended to deliver broad national outcomes congruent with these goals. The APAS document will soon be available at www.apas.net.au, together with further descriptions and links relating to rangeland and other pests.

Shrub removal and grazing alter the spatial distribution of infiltrability in a shrub – encroached woodland

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Keywords: infiltration; spatial pattern; disturbance

Abstract

The tendency of water to infiltrate (infiltrability) determines the productivity of rangelands. However, how patterns of infiltrability change in response to gradients of disturbance remains largely unexplored. To address this, we examined changes in the pattern of infiltrability across a disturbance gradient in a semi-arid Australian woodland. We measured the spatial distribution of infiltrability in relation to distance from the canopy of trees and shrubs at long ungrazed sites to ploughed and grazed sites. Infiltrability on long ungrazed sites was relatively homogenous throughout the landscape and up to distances of four metres from plant canopies. In contrast, at either grazed or grazed and ploughed sites, infiltrability was demonstrated a heterogeneous pattern across the plot. Infiltrability was also greatest only around vegetated patches but very low at distance of more than 2 m from woody plant canopies. Factors such as increased bulk density and removal of cryptogamic soil crusts as a result of livestock trampling are probably responsible for the heterogeneous patterns of infiltrability. Our results highlight the importance of maintaining woody plants for maximising infiltration of water in the semi-arid woodland. Removal of woody shrubs by ploughing with and without grazing appears to have a deleterious effect on infiltrability.

Feral camels in the Australian rangelands

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Keywords: biodiversity protection; camel harvesting; Indigenous

Abstract

The growing size and impact of the feral camel population in Australia's rangelands has emerged as a serious issue of management. The usual rangelands issues of remoteness, low human population density and limited capacity are compounded by the mobility of camels and their extreme hardiness in ostensibly hostile environments. There are commercial and non-commercial options for dealing with the feral camel population, with commercial options constrained by limited processing capacity and a market for camel products unwilling to pay the real costs of production.

Can we kick-start mining rehabilitation with cyanobacterial crusts?

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Keywords: mining; rehabilitation; cyanobacteria

Abstract

A heavy mineral sand mine has commenced operations on the eastern edge of the Nullarbor Plain, South Australia. This area has low annual rainfall and frequent drought, resulting in challenges in relation to rehabilitation. The soil is fragile and prone to wind erosion during, and, following disturbance. Prior to disturbance, the soil surface is well stabilized by cyanobacterial soil crusts and chenopod dominated vegetation. The ecosystem benefits of cyanobacterial crusts include surface soil stabilisation and reduction in wind and water erosion, increased water infiltration, nitrogen and carbon fixation. Beginning the rehabilitation process with a cyanobacterial crust may therefore offer the soil protection, as well as the start of biological processes that survive harsh conditions due to their ability to deactivate and reactivate according to seasonal conditions. Using cyanobacteria as a kick-start for mining rehabilitation is not commonplace practice in the Australian rangelands. A new research program is underway with the University of Queensland to assess the potential for using components of the cyanobacterial soil crust to stabilise soil stockpiles and rehabilitated land surfaces.

Demonstrating implementation of invasive native scrub property vegetation plans

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Keywords: INS (Invasive Native Scrub); PVPs (Property Vegetation Plans); demonstration; implementation

Abstract

Invasive native scrub (INS) has caused major changes to landscapes in the Western Catchment of NSW. To allow for the management of INS under the Native Vegetation Act 2003 a simplified assessment process was developed for INS Property Vegetation Plans (PVPs).

The Western Catchment Management Authority (CMA) has established five sites to demonstrate the implementation of INS PVPs. The INS management at these sites uses a combination of the clearing types available under an INS PVP. The management must comply with the conditions of the PVP to ensure environmental outcomes are improved or maintained. The requirements of the PVP are outlined in this paper. Using the demonstration sites to provide information to landholders, contractors and staff leads to more effective management of INS and compliance with PVPs.

An effective INS PVP will result in a mosaic of native vegetation types in the landscape creating a diversity of habitats. The control of INS has benefits for production and the environment with improved native groundcover and soil stability.

Plant facilitation under trees and shrubs along a degradation gradient

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Keywords: facilitation; competition; shrubs; encroachment; woody weeds; shrubland

Abstract

Traditionally the presence of large numbers of woody plants in rangelands is thought to reflect declining rangeland health and reduced pastoral productivity. However, an increasing body of evidence suggests that shrubs may provide an important ecological role by providing habitat for understorey plants, particularly in overgrazed and degraded rangeland. To test this we examined the role of trees and shrubs in facilitating understorey growth along a gradient representing three degradation states in semi-arid Australia. There was a significant difference in plant composition under tree and shrub canopies and in the open along the degradation gradient. We recorded significantly greater plant richness (Chao2-adjusted) under shrubs (17.1 species) than under trees (12.4) or in the open (8.2). Larger shrub canopies supported more species, and this effect was more pronounced with increasing degradation. Our results indicate that the sub-canopy area of woody shrubs likely facilitates the growth and survival of a diverse and productive understorey community. Studies of the relative effects of trees and shrubs on soil surface processes are needed to enhance our understanding of the importance of woody plants as facilitators of plant growth in semi-arid environments.

Beyond Black Stumps: fostering improved ecological and economic outcomes on Aboriginal held pastoral stations

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Keywords: Aboriginal; pastoralism; economic

Abstract

Western Australia has 57 of its approximately 500 pastoral leases owned in some form by Aboriginal communities. Ownership of pastoral leases has provided many Aboriginal communities in the rangelands the opportunity to access and care for their traditional lands in a culturally meaningful way. However, inadequate governance, management and incentives pose significant challenges to the success of Aboriginal held pastoral leases, resulting in many underperforming on a range of commercial and environmental indicators. To help understand these issues and identify strategies to support the success of Aboriginal pastoralism, the Western Australian government commissioned a review of the circumstances surrounding this industry sector. The government subsequently implemented the key recommendation of the review, being the establishment of an Indigenous Pastoral Enterprise Development service. Two case studies illustrate how this service has improved commercial and ecological outcomes on Aboriginal held pastoral leases. The case studies also provide a model for utilising the rangelands economic potential for Aboriginal communities while developing the capacity to appropriately care for its natural assets.

A journey into the future of the Australian rangelands

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Keywords: songlines; rangelands; regional economies

Abstract

Through our experiences and partnerships at Desert Knowledge CRC we have accumulated a combination of expertise and commitment to tackle the issues facing people in remote Australia, which we are now building into CRC-REP. The three main themes of our research will be: 1) Regional Economies, 2) Enterprise Development, and 3), Investing in People. In this paper we expand on our philosophy, research themes and approach.

Making better use of grazing charts in rangeland grazing enterprises

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Keywords: grazing charts, seasonal risk, planned grazing

Abstract

Data contained in grazing charts are often underutilised. We describe a simple spreadsheet program that uses these data, and a carrying capacity benchmark expressed in terms of DSE days/ha/100 mm of rainfall, to estimate future carrying capacity under specific seasonal scenarios and compare it with the planned stocking rate. Experience to date suggests that such comparisons have potential to aid management of grazing and seasonal risk in rangeland enterprises.

Woody weeds, rabbits and weconstruction Australia's rangelands: A future vision

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Keywords: pastoralism, interdisciplinary research, community attitudes

Abstract:

Research and Development in the rangelands of Australia has typically been reductionist in nature, focussing on segments of what is in reality a deeply integrated system of interaction containing social and natural elements. For example, work on production and productivity has been poorly integrated with the issues of social systems (markets and marketing) and ecological sustainability, biodiversity and lately carbon storage and sequestration. The landscape's main resource has been seen as based in agriculture, and this in turn has been driven by the issues of production and productivity

Agriculture faces increasing economic pressures in terms of long term net returns; in terms of political and social influence and in terms of wider community values surrounding natural resource management, food production systems and responses to climate change. Accommodating this new and exciting future, it is argued that there needs to be changes in both community attitudes and the direction of scientific research. Community attitudes need to be imaginative, proactive and recognise the changed economic, social and environmental context that rangelands inhabitants now find themselves in. For scientists, the challenges are similar, but also include the need to work in an interdisciplinary manner, to see research and development as underpinning and informing management as well as integrating research more fully with all areas in which it has an impact.

Putting our heads together

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Keywords: collaboration; synergy; outcomes

Abstract

The National Rangeland NRM Alliance (The Alliance) combines thirteen (13) rangeland NRM organisations and represents 80% of Australia's land mass. The Alliance aims to improve the delivery of NRM in the rangelands at a national level to improve sustainable land management in the rangelands of Australia.

The driving force behind this group is the recognition that many rangeland issues require a national approach and that competition for funding around those issues is counterproductive. The members see the Alliance as a solution to the difficulties associated with implementing large-scale action across regional and jurisdictional boundaries.

The combined resources of the Alliance provide investors, policy makers and partners with services beyond the scope of the individual organisations. This includes strategic planning and partnerships that result in much greater impact and the ability to tackle issues, which individual groups may find overwhelming and have difficulty managing in the long term. The Alliance members, and partners, use their existing governance and project implementation structures to achieve on-ground results at a national scale.

Restoring health to key floodplains using geomorphic ecology in the upper Gascoyne, Western Australia: the Three Rivers story

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Keywords: Landscape scale restoration, rehydration, erosion treatments

Abstract

The Three Rivers Restoration Project is a leading example in Western Australia of a successful collaborative catchment level (broad-scale) restoration project in arid Australia. This is a family run pastoral lease of some 500,000 hectares, dedicated to the ecologically sustainable production of beef. The Forsyth family have managed this land since 1973. In 2004 the Forsyth Family embraced the knowledge provided by the Ecosystem Management Understanding (EMU) Process, delivered by Dr Ken Tinley and Dr Hugh Pringle. Following extensive aerial and then on ground investigations, the Forsyth family developed a detailed, staged intervention plan with Dr Tinley and began implementing the planned strategies by mid 2004. Works have included the installation of numerous channel calming "rakes", scrub packing and bunding treatments in gullied floodplains and bunding to reverse unnatural catchment piracy that had been causing dehydration to an extensive floodplain and swamp. Planned works include the rehydration of approximately 50,000 hectares of degraded floodplain and extensive pasture regeneration to assist water infiltration and soil stability. The broad scale of the Three Rivers Project, being co-ordinated by one management entity over such a vast area, is a unique chance to observe what can be done in arid environments to slow and reverse erosion, regenerate landscapes and mitigate against climate change through restored landscape drought buffering, maximise carbon sequestration as well as providing increasingly high quality habitat for livestock and local wildlife. The Forsyth's are also developing a localised "rest based" grazing plan, balancing livestock pasture demands with the fundamental requirements of the landscapes that provide it and the production cycle with extraordinarily low seasonal predictability. Project Manager Ben Forsyth will discuss the methods used and developed at Three Rivers, the important community relationships that have created this unique opportunity and his experiences with landscape scale restoration.

A national scientific reference site network within the Terrestrial Ecosystem Research Network, site stratification and establishment methods

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Keywords: biodiversity; rangelands; reference sites

Abstract

The Australian rangelands cover around 80% of the continent yet, from a biodiversity perspective, probably constitutes the most understudied part. To further the understanding of these ecosystems and progress analytical and predictive modelling, the Terrestrial Ecosystem Research Network (TERN) through a collaboration between Adelaide University and the SA Department of Environment and Natural Resources, is in the initial stages of a process to establish a National Scientific Reference Site Network (NSRSN) across the rangelands. This paper describes the TERN setup.

Rain on the rangelands: how intense is it?

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Keywords: rainfall intensity; runoff; climate change

Abstract

Sub-daily rainfall intensity has a significant impact on runoff and erosion rates in northern Australian rangelands. It is therefore important to accurately represent sub-daily rainfall intensity in rangeland systems models (e.g. GRASP), which are used to investigate management impacts on runoff and soil erosion processes. We describe a new equation to calculate daily maximum 15-minute rainfall intensities (I15) for any location in Australia, using readily available daily rainfall and climate data. The new I15 model accounted for 46% ($P < 0.01$) of the variation in observed daily I15 for an independent validation data set derived from 67 Australia-wide pluviograph stations and represented both geographical and seasonal variability in I15. The model also accounted for 70% ($P < 0.01$) of the variation in the observed historical trend in I15 for the full record period (average record period was 37 years) of 73 Australia-wide pluviograph stations. The new I15 equation represents a significant improvement on the existing equation incorporated in GRASP, which needs to be calibrated for a given location.

Rainfall use efficiency, natural resource management and profitable production in the rangelands

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Keywords: rainfall, use, efficiency

Abstract

Rainfall use efficiency (RUE) is suggested as a measure of the productive use of the weather and measures the amount of rainfall that is converted into agricultural products. Rainfall use efficiency measures the interaction between rainfall, solar energy inputs and wind run and plant primary production. The greater the proportion of available rainfall that is productively used by plants, the more profitable and productive is the agricultural system. Natural resource management practices that address wastage in rainfall use and maximise RUE will maximise the profitability and productivity of farm businesses. These practices will also be shown to provide the best chances for maintaining landscape resilience to natural and man-made shocks to these systems. The conditions that maximise rainfall use efficiency are: 1) sufficient groundcover to minimise run off and soil loss by wind and/or water erosion, 2) sufficient litter to minimise evaporative water loss and maintain surface soil structure, 3) sufficient green pasture mass to maximise photosynthetic efficiency, 4) a diversity of plant species sufficient to ensure that rainfall at any time of the year can be utilised productively, 5) sufficient shelter to minimise water loss to evaporation, excessive evapotranspiration and heat and wind stress on animals, and 6) soil that is not limiting to plant production due to biological, chemical or physical constraints. Maintaining these conditions ensures that rangelands are kept in a more resilient state.

Western Catchment Aboriginal knowledge system – *Through our eyes: Aboriginal knowledge, past present future*

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Barnes: Public Relations and Media Officer, Western Catchment Management Authority, Dubbo NSW

Keywords: Aboriginal knowledge systems; Aboriginal language groups; sustainable land management

Abstract

The Western Catchment Management Authority (CMA) works with local people to improve the management of natural resources. In line with the government's 'Caring for Our Country' priorities we believe that raising awareness and providing information about Aboriginal perspectives on natural resource management will improve the management of our natural resources. Aboriginal people have much to teach today's land managers and the wider community about caring for our country. Here we will present a DVD that is part of a larger project to document Aboriginal land management practices and cultural knowledge. Our aim is to make this knowledge accessible for current and future generations.

Guidelines for determining lease land condition – Queensland’s Delbessie Agreement (State Rural Leasehold Land Strategy)

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Keywords: condition; assessment; Queensland

Abstract

The “Guidelines for determining lease land condition” (the Guidelines) were developed by the Queensland Department of Environment and Resource Management (DERM) to support implementation of the Delbessie Agreement (State Rural Leasehold Land Strategy) which took effect from 1 January 2008. The Guidelines are designed around the eight elements of the Land Act 1994 ‘duty of care’ and defined elements of land degradation. They synthesise a range of accepted land management principles and practices into a defensible framework that can be applied consistently across Queensland, independent of climate and natural variability. The assessment of key indicators of long-term land condition is captured as a ‘point-in-time’ benchmark to guide future land management. On ground assessment is supported by leading remote sensing and modelling tools and supported by a suite of purpose-built IT applications.

Conserving artesian water for future generations

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Keywords: Great Artesian Basin; sustainability; bores

Abstract

The Great Artesian Basin (GAB) is one of Australia’s most significant national assets and it underlies 22 per cent of Australia. Much of the GAB underlies the rangelands of NSW, Queensland, South Australia and the Northern Territory. It is often the only reliable water source available to these areas, especially during the drought years. In the past 100 years it is estimated about 50 million megalitres has been extracted from the basin, mostly through free flowing bores. The Australian Government is investing close to \$140 million over fifteen years (1999-2014) through the Great Artesian Basin Sustainability Initiative (GABSI) to accelerate work on the repair of these often very old uncontrolled artesian bores and the replacement of open bore drains with piped water reticulation systems, thereby reducing the wastage of water.

Perennial grass survival in drought

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Keywords: semi-arid grasslands; tillers; death

Abstract

The survival of perennial grass plants in drought is of scientific and applied interest; scientists want to know why species differ in ability to cope with individual and combined stresses of drought, grazing and fire, and graziers want to maximise survival of desirable forage plants because natural replacement can be very unreliable. Five species taken from Canberra grasslands were glasshouse-grown in large 1 m tall pots for one year and then watering ceased. The rate of passage through early drought stages differed between species. Rewatering plants at various times from onset of full drought was used to determine viability from which survivorship curves were generated. Three native grasses (*Themeda triandra*, *Austrodanthonia auriculata* and *Bothriochloa macra*) and one exotic species (*Phalaris aquatica*) had similar survivorship curves with 50% survival between 60 and 120 days. For the second exotic species, *Eragrostis curvula*, 50% survival was at 260 days. Density of viable tillers generally declined during drought before plant death.

Tactical grazing: an evaluation in eastern semi-arid woodlands

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⁴Department of Employment, Economic Development and Innovation, LMB 4, Moorooka, Q 4105.

Keywords: drought; grass; shrub; plant density

Abstract

Transition from an open wooded grassland state to a shrubby woodland state, and the reverse, is driven by the agents of prolonged rainfall events, drought, fire and grazing. We altered the grazing regimes over a 10-year period at 10 widely spaced sites in the north west of the Murray Darling Basin, to examine whether a transition can be achieved by resting from grazing alone. The three grazing regimes were: tactical grazing, continuous grazing and no grazing. Statistically significant year x treatment interactions for grass density were found at only three sites and for shrub density, at six sites. Provisional conclusions from the data are that tactical grazing has a role in the transition to grass dominance in semi-arid woodlands but the change is equivocal.

Restoration of semi-arid zone wetlands: the Macquarie Marshes

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Keywords: arid zone; policy; irrigation

Abstract

In order to restore degraded semi-arid zone wetlands in NSW, Government policy has focused on purchasing water to increase their allocation of environmental water.

In this paper I draw on a wide range of sources to realistically describe the Macquarie Marshes in western NSW throughout their known history. I explore the causes of degradation of the Marshes, and find clear evidence that wetland degradation was well underway prior to river regulation and the development of an upstream irrigation industry. More recently I find that environmental water is increasingly being captured or diverted from core wetlands, exacerbating their decline. I conclude that water purchase alone will not restore the Macquarie Marshes. I recommend a much more holistic approach, with two main thrusts. Firstly, environmental water releases must be closely monitored to ensure they reach the targeted wetlands. Secondly, options to improve land management must be explored. I recommend the option of land purchase and conservation management of key wetland properties based on preliminary findings at 'Burrima'.

People, Land, Opportunity: Marrying Indigenous Land Management and Economic Development in the Rangelands

Jeffries, S.

Deputy Chairperson, Indigenous Land Corporation

Keywords: land management, Indigenous, country, economic development

Abstract

The Indigenous Land Corporation (ILC) is an independent Australian Government statutory authority, established to provide social, cultural, economic and environmental benefits to Indigenous people by assisting them to acquire and manage land. The ILC Board believes that land ownership and management provides opportunities for accredited training that will facilitate employment outcomes and in doing so encourage sustainable Indigenous economic development which can benefit both individuals and whole communities. In this presentation I will present several case studies that reflect the ILC's practical approach to create sustainable benefits for communities. These case studies focus on the socio-economic benefits being delivered through long-term land management projects in the Brewarrina region of NSW, in the Kimberley and across Australia's Top End.

Regenerating Naree through changing management strategies

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Keywords: pastoralism, wetlands, rehabilitation

Abstract

The Cuttaburra Creek is a distributary of the Warrego River and connects the Warrego River to the Paroo River. It is well known for its wetland, the Cuttaburra Basin, a freshwater inland wetland that encompasses 37,000 ha. This is an area of some 12km wide and over 20 km long, still relatively healthy, and the only one of this nature in Australia. The floodplains along the Cuttaburra Creek are inspiring to watch as they fill shallow lakes, swamps and inland wetlands on their way down to the Paroo. The water spreads out across the country like veins on a leaf and, in major flood event can be 15km wide. Those that depend on the floodplain of the Cuttaburra are well aware of the value of the land both economically and environmentally. The vegetation and birdlife that this system supports are diverse and distinctive and in fact home to flora and fauna listed on the Australian endangered species list.

Our experience has shown us that an increase in biodiversity directly relates to an increase in quantity and quality of available stock feed. Naree is unique in that we have such a diverse range of vegetation and flood systems and to us the key to maintaining our current vegetation and ground cover base involves careful management of our paddocks by removing stock when grasses dictate. We can measure our available feed in our floodplain paddocks by the size of the flood event we are expecting. We can directly relate the volume of water passing through Cunnamulla, to the expected increase in feed growth and pasture volume during a given event.

What if anything have we learnt about sustainable management of inland river systems?

Kingsford, R.

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Keywords: Murray Darling Basin, development, water plans, rivers

Abstract

A long history of water resource development on the rivers of the Murray-Darling Basin has produced significant ecological impacts on wetlands for which the States and Commonwealth have national and international sustainability obligations. As a result, Australia is embarking on one of the most significant wetland and river rehabilitation projects in the world through the buy-back of irrigation licences for environmental flows and improved efficiency of irrigation systems (\$8.9 billion). The Australian Government has also formed an independent Murray-Darling Basin Plan to manage the rivers of the basin. What have we learnt from such understanding and what are the future challenges? Are there other levers for sustainability rather than just regulation and rehabilitation of rivers? What other potential 'carrot' and 'stick' incentives exist. Perhaps it is time to reward people and industries that practice sustainability or penalise those that do not in the market place. Sustainability of rivers in inland Australia will be governed by how much we can rehabilitate the Murray-Darling Basin and how much we wish to protect free-flowing rivers.

Shrub-resident arthropods in an *Eremophila* and *Senna*-dominated shrubland

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² Department of Environment, Climate Change and Water, C/- Evolution and Ecology Research Centre, School of Biological, Earth and Environmental Sciences, University of New South Wales, Sydney, NSW, 2052, Australia.

Keywords: arthropod; shrub; resources

Abstract

Though shrub-encroached landscapes are viewed by some as 'ecological deserts', we know little of the biodiversity that they support. We investigated the shrub-resident arthropods in a turpentine (*Eremophila sturtii*)-silver cassia (*Senna artemisioides*) shrubland in eastern Australia, and how fine-scale shrub density affects these communities. We found that turpentine supported six times more arthropods than silver cassia (*Hemiptera*, *Psocoptera* and *Collembola*), as well as a distinct species assemblage of Hemipterans. Fine-scale shrub density also affects the Hemipteran community, particularly on silver cassia. We have shown that shrub-encroached landscapes support healthy arthropod communities, which are structured by shrub species and fine-scale patterns of shrub density.

Rest after rainfall: the carbon grazing story

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Keywords: carbon flows; resilience; strategic pasture rest

Abstract

Increasing carbon stocks is dependent upon better management of carbon flows in and slowing flows out. This relies on three strategies: 1) Focusing on the point in time when the bulk of carbon arrives (i.e. the Carbon Grazing principle). 2) Increasing the pathways by which carbon is able to enter the landscape. 3) Improving landscape resilience. How successfully plants introduce carbon into the landscape is determined by animal management. Plants and animals have evolved together and rely on each other. However, if animals dominate plants, then carbon flows and carbon stocks are reduced. In the absence of animals, plants become moribund and therefore have a lower capacity to photosynthesise.

A landholder's perspective of land restoration on Todmorden Station, Oodnadatta SA

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Keywords: rehydration; practicalities; partnerships

Abstract

What is new to our management is active landscape restoration, which we have commenced by participating in the Ecosystem Management Understanding (EMU) Project™ through the Neales River Catchment Pilot Project. While we are committed to progressing with restoration activities, we see these as being inextricably linked and inter-dependent with our feral animal control, grazing management and other aspects of our whole business. Indeed this vigilant management enhances the likelihood of restoration activities succeeding. In this article I offer my personal perspective as a pastoralist.

Natural resources governance for the drylands of the Murray-Darling Basin

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Keywords: Murray Darling Basin, drylands, governance

Abstract

Recent years have seen rapid expansion in the critique of arrangements for the governance of natural resources in Australia. Concurrently, there has been a growing assertion internationally that drylands share features that justify a specific 'desert syndrome' conceptualisation of how to manage them. These issues come together in the drylands of the Murray Darling Basin (MDB). We explore in this paper the insights that this convergence provides for designing governance arrangements for the natural resources of the MDB. We argue that the characteristics of the MDB drylands justify transformation of these arrangements to those of adaptive governance; and more specifically that this model of governance should be founded on the related concepts of polycentricity and subsidiarity. We explain how three aspects of polycentric governance contribute to the robustness of social-ecological systems and identify the particular relevance of each to the MDB drylands. Even so, transformation to polycentric governance would face formidable obstacles from vested interests and mental models that have adapted to the status quo. Acknowledging the reality that hurdling such obstacles requires strategic preparation to exploit windows of opportunity, we propose a number of pragmatic steps to be followed in strategically pre-adapting the MDB drylands for this transformation. Although transforming to adaptive governance comes with risks, we contend that the risks of inaction for the MDB drylands are greater.

Conservation of critically endangered wildlife species – scope for private landholder and citizens' action

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Keywords: Bridled Nailtail Wallaby; conservation; private grazing land

Abstract

The conservation status of wildlife on private grazing land is contentious. For macropods this ranges from ubiquitous pest species (e.g. kangaroos) to critically endangered for many of the smaller macropods, including the Bridled Nailtail Wallaby, which was thought to be extinct until 'rediscovery' in 1973 in Central Queensland. Recovery activities for the Bridled Nailtail Wallaby in Queensland are being undertaken at Taunton N.P. (Scientific) and Idalia N.P. A third reintroduction effort commenced on "Avocet", a grazing property in the Central Highlands in 2001; and presently involves a consortium of interests including a pastoral enterprise, a sporting shooters association, community volunteers, a conservation trust and the Department of Environment and Resource Management (DERM). The paper details elements of the history of wallaby recovery efforts on "Avocet" and how this model might offer scope for private individuals and community interests to contribute to endangered species conservation outside the formal conservation estate.

A comparative analysis of two feral goat management methods commonly used in the Cobar district to restore native groundcover

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²Western Catchment Management Authority, Cobar NSW

Keywords: Feral goats; total grazing pressure; harvesting operation

Abstract

Feral goats are a significant contributor to total grazing pressure in the Cobar district. The aim of this paper is to compare two methods of managing feral goats used on a Cobar district property, 'Gilgunnia', and their impact on groundcover and biomass. The two management methods discussed in this paper are a) harvesting feral goats by trapping watering points and b) a controlled situation using mesh-type fencing to eliminate all feral goats from that area. To assess the pasture biomass and the impacts of grazing, data was collected from four sites over a three-year period using the step-point monitoring method together with clippings collected in 2010. Overall, the data shows an improvement in vegetation groundcover for both harvesting and the controlled area over the three-year period, although the rate and extent of groundcover improvement was significantly higher in the area under total grazing pressure control. The landholder believes the better results in the controlled situation are due to complete control of feral goats and the rotational grazing system in place. The results cannot be achieved without the use of mesh-type fencing, which is costly. However, the harvesting operation funds the development of the total grazing pressure control system. The two management systems on 'Gilgunnia' complement one another to achieve an ever-increasing area of high groundcover and good pasture biomass.

Inundation patterns and vegetation responses in the Paroo and Warrego catchments using multi-temporal Radar remote sensing

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Keywords: Paroo; Remote Sensing; Wetlands

Abstract

Freshwater is a vital resource in Australia, and its availability is highly variable in semi-arid and arid. Rapidly expanding water resource development in the Murray Darling Basin (MDB) has impacted natural flow regimes and the ecological integrity of many dryland rivers and their large floodplain wetlands. Efforts to manage and conserve the surface waters of rivers in the MDB are hampered by limited scientific data regarding historical and contemporary flow and inundation patterns and of responses of flora and fauna to the high natural variability of flow regimes that typify the lowland-dryland rivers.

Waterspreading to restore native grasslands

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Keywords: waterspreading; environmental; invasive native scrub; land management; soil carbon

Abstract

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

Estimating the cost of protecting biodiversity on privately managed properties in the Australian Rangelands

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Keywords: trade-offs; conservation; private costs

Abstract

A significant quantity of native vegetation and biodiversity exists on privately managed rangeland properties. However, landholders do not always conserve these resources at a level that society desires, due to a lack of appropriate market signals. Policies involving regulation can impose substantial costs to landholders. Market Based Instruments (MBI) have therefore been introduced to provide market incentives for conservation. In a case study of an MBI scheme, we estimate the costs of protecting biodiversity on privately managed properties in Western NSW. The cost of this on different conservation areas varied widely.

Pera Bore Experiment Farm: Greening the 'Howling Desert'

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Keywords: Artesian water; history of science; experiment farms

Abstract

In the late nineteenth century the Pera Bore, not far from Bourke, became the site of a unique experiment farm. No other government experiment farm was located so far from a capital city or agricultural district. The experiments were to test the suitability of old rain – artesian water – for irrigating small agricultural holdings in the rangelands. What happened at Pera Bore and why was it built? What agenda drove the push for agriculture in the dry interior? How did the experiences at Pera Bore and other western experiment farms shape science and broader attitudes towards the occupation of semi-arid places? This paper explores a short episode in the early history of agricultural science in Australia, and asks what might the story of the western experiment farms bring to current reflections on knowledge for place?

Can root biomass of grasses in NSW be predicted from shoot biomass yields?

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Keywords: C₃ vs C₄ grasses; photoassimilated carbon; root:shoot ratios; species differences

Abstract

We evaluated shoot and root biomass yields of four native grasses of NSW and an introduced species in order to establish if differences in shoot- and root-biomass yields as well as root:shoot ratios existed among the species. We also explored the potential to predict root biomass from shoot biomass of each species. The species were grown in trays with conical holes of volume 180 cm³ uniformly packed with sand (0.1 – 0.8 mm grain size) amended with potting mix (50/50 v/v) in a glasshouse experiment. The trays were arranged in a replicated randomised complete block design. After eight weeks, the shoots and respective roots of randomly selected plants per species were harvested and oven-dried for biomass determination. Data were subjected to ANOVA in R after square root transformation normalised the data. We found remarkable differences in shoot biomass, root biomass and root/shoot ratios among the species. *Microlaena stipoides* gave strongest positive linear relationship ($R^2 = 0.8$) between root biomass and shoot yield while *Austrodanthonia spp.* showed no significant relationship between the two variables. These interrelationships must be investigated under field conditions before root biomass can be meaningfully modeled from known shoot biomass yields, taking into consideration the implications of these differences for carbon storage.

Long-term profitability and sustainability of grazing strategies in a tropical savanna in north Queensland

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Keywords: stocking rate; rainfall variability; pasture density

Abstract

Rainfall variability is a major challenge to sustainable management on rangelands. We present data from a grazing trial in north Queensland on the relative performance of moderate (MSR), heavy (HSR), two variable (VAR and SOI) stocking rates and a rotational spelling (R/Spell) strategy, over a 12-year period. VAR strategy involved adjusting stocking rate according to pasture mass at the end of the wet season and SOI adjustment based on the Southern Oscillation Index and pasture mass. The density of palatable, productive and perennial grasses after 12 years was markedly higher in the MSR and R/Spell than in the VAR and SOI but was by far the lowest in the HSR. Accumulated cash surplus at the end of the 12 years was far lower in the HSR relative to the other strategies. These results directly challenge the assumption that sustainability and profitability are incompatible in rangelands.

The occurrence and causes of episodic recruitment of *Astrebla* spp.

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Keywords: episodic recruitment; *Astrebla* spp.; El Nino Southern Oscillation.

Abstract

This paper examines the seasonal climate patterns resulting in three large and apparently rare episodic recruitments of *Astrebla* spp. in Queensland. Each of these recruitments occurred following a 3-year rainfall sequence of: above average rainfall in the first summer, below average rainfall throughout the second year followed by above average rainfall in the third summer. Each of these recruitment events was associated with the occurrence of the El Nino Southern Oscillation weather phenomenon. It is concluded that modelling the frequency of recruitment could identify those regions needing more precise grazing management.

Catchment restoration bears fruit on Wooleen Station, Murchison, WA.

Pollock, D.

Wooleen Station, Murchison, 6630; Western Australia

Keywords: pastoralism; rehabilitation, mulga shrublands

Abstract

The mulga shrublands, like all rangelands, is an area of huge contrast, and has the ability to change with great rapidity. Following drought breaking rains the landscape is transformed in every way, and the miraculous appears overnight.

As a manager of the rangelands I have become increasingly aware that this is not the real face of the rangelands, and while it is a welcome respite, the rangelands move at a much slower pace. Short lived annual grasses and herbs literally spring to life from these rains, but a much more important germination will also be taking place.

This is the germination of the perennial grasses that will hold the landscape together during the next drought, which we know will come. This is the germination of the tall trees for the Australian people to admire in four hundred years time. This is the germination of the exact same individual saltbushes and bluebushes that 9th, 10th, 15th generation pastoralists will stand next to in the future, and marvel over their productivity. If only we are able to manage the rangelands in a way that they may survive.

For these plants are in a precarious position soon after they emerge. By the next summer we all know that the annual herbs will have all died and blown away, and all we will be left with is the germination of the most important plants that are still no higher than our ankles. For these most important plants do not spring out of the ground. They grow very slowly. And they live a very long time. It is almost certain that these plants will still be small when the next drought comes, and if we have managed them well, they will be the cement that holds our rangelands together when the next drought breaking rains arrive.

The real face of the rangelands is visible before the rain, and its health should be measured at this bleakest of times. For only at this time can we see the country's ability to withstand those first drops on dusty soils. Only at this time can we assess whether our management has been good enough to ensure that no lasting harm will come to the renewable resource that we manage for the Australian people.

My presentation will be a brief overview of how Wooleen Station has been tackling the problem of long term sustainability in the rangelands, and how we have come to the realisations that we have. I will address the balancing act of staying financially viable while also rehabilitating the pasture. While my pasture knowledge is restricted to the mulga shrublands, I believe that much of what we are setting out to achieve is applicable in most areas, and could be used to create a sustainable pastoral industry in the rangelands over the next twenty years.

Understanding rangelands as dynamic catchment ecosystems

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Keywords: hierarchy; geomorphology; soil moisture balance

Abstract

There are many factors that affect rangeland productivity and how it is channelled through “natural” and livestock components of food webs. There are pastoral programmes that address many of these factors quite specifically, be they commercial or taxpayer funded. In all of them, there is much good substance. The fundamentals of managing stocking rate and so forth are as relevant today as ever. What may be lacking in all of them is an understanding of rangelands as more than static mosaics of country types, though this appreciation is not structurally excluded from some programmes. Given that pastoral production depends on primary plant productivity and that this requires positive soil moisture balance, should we not also look at what drives patterns of soil moisture balance and how this can be enhanced? This ecosystem appreciation of how to manage the factors driving primary productivity has global significance.

Aboriginal representation and participation in caring for country

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Keywords: Aboriginal culture; management; caring for country

Abstract

This paper introduces Walgett’s Dharriwaa Elders Group and its role to provide advocacy and representation for Walgett Aboriginal elders in Aboriginal cultural management and community development activities. It explains why it is important for Aboriginal people to first know about, and then actively participate in any scientific, planning, management and development activities in their country of interest. It discusses why Aboriginal participation in caring for country is and has been difficult, and cites examples from its experience with the Narran Lakes Co-Management Committee and the Catchment Management Authorities. It proposes a more effective model for the promotions of Aboriginal participation in caring for country, including how advisory and co-management committees could work better. It gives a summary of the work of the Dharriwaa Elders Group in trying to protect the Aboriginal cultural heritage values of the area known as Opal Prospecting 4, adjacent to the Narran Lakes Nature Reserve, and ends by suggesting ways that Aboriginal communities can participate more usefully in the management of landscapes. Indeed, the DEG has its own cultural heritage management strategy to provide for the protection and preservation of areas with known and important Aboriginal heritage values, which identifies all of the resources, responsibilities and procedures needed to prevent deterioration of Aboriginal cultural values.

Manipulating feral goat access to water in the Rangelands

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Keywords: feral goat; access to water; pest animal management

Abstract

Feral goats are a recognised threat to biodiversity and their management in the rangelands is difficult. Using the dependence of feral goats for regular water, we investigated the effectiveness of strategic goat-proof boundary fencing to reduce goat abundance and impact on conservation reserves. Twelve months after completing fence construction, feral goat indices significantly declined and there were significant changes in ground cover. The management implications of our findings are discussed.

The Northern Grazing Systems Project: Estimating safe stocking rate

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2. NT Department of Resources, PO Box 1346, Katherine, NT 0851, Australia.

3. CSIRO Sustainable Ecosystems, 306 Carmody Rd, St Lucia Q 4067

Keywords: utilisation rate; extensive grazing; simulation modelling

Abstract

The Northern Grazing Systems project aims to increase adoption of innovative best-practice grazing management by beef producers throughout northern Australia. Four key areas requiring research, development and extension have been identified: stocking rate management; pasture resting; use of fire; and infrastructure development. The three main project components are: synthesis of literature; bio-economic modelling at whole beef enterprise scale; and regional guideline development.

Simulations with the GRASP model were used to identify the safe stocking rate for various land types and locations. Safe stocking rate was defined as the fixed stocking rate that produced a mean percentage of perennials in the pasture of 70%. The utilisation rate corresponding to these stocking rates for a fertile land type was 18% at Longreach to 35% at Calliope in simulations using the same parameters other than climate station. For an infertile land type, the differences in safe utilisation rate and the differences in mean pasture production led to a five-fold difference in the safe stocking rate from Longreach to Calliope.

A journey down the Warrego

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"Wallen", Cunnamulla QLD 4490, South West NRM, Charleville QLD

Keywords: Warrego River; floodplain; flood

Abstract

"Who took the water?" said Barney from Bourke after the January 2008 flood. A half a metre of rain in Charleville and very little got into the Darling. The long and short answer is the environment got the lot, as no water was pumped out of the system in this flood event. This paper will attempt to follow a flood down the system from the rain event to where the water finished up.

Changes in gully erosion along the Upper Burdekin River frontage in north Queensland.

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Keywords: gully erosion; remote sensing; GBR

Abstract

Gully erosion has been identified as a significant source of sediment in the seasonally dry tropical savannas of the Burdekin catchment with the upper Burdekin subcatchment having the highest incidence of gullies. A simple method of calculating changes in gullied areas is provided. A 22% expansion of one gully network over a 58-year period was calculated using a time series of aerial photographs and satellite imagery. This work supported by mid-19th century explorer diaries clearly indicates that gully erosion in this area commenced well before the introduction of domestic livestock in the 1860s. The need for wider-scale quantification of gully erosion is also highlighted.

Adapting to climate change: concentrate on getting the basics of property management right

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Keywords: grazing pressure; business plan; distractions

Abstract

A pastoral property manager has many issues to deal with and a surprisingly large number of options to consider. Many of those issues can relate to family or personal matters and not the traditional financial or production aspects of a business. Then there are the exhortations from modern urban media to act upon a wide diversity of "critical" matters. Many of these recently are aligned with environmental stewardship, preservation of biodiversity, food safety, animal welfare and taxing of carbon consumption. We suggest that such matters mostly have little impact on business profitability for rangeland pastoral enterprises but can create negative personal energy and distract from the main game. Income is driven largely by seasonal rainfall (which is unreliable and uncontrollable), but profitability is driven mostly by sound business management practices. Good planning, preparedness and timely decision making is needed and intrinsic to that is matching grazing animal numbers to available feed supply. If this is done well, most other controllable enterprise options will become much easier to manage for a profitable outcome.

Quantum innovation in measuring, monitoring and managing ecological function on large scales, reliably and affordably

Simonds, G.

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Keywords: monitoring; function; GIS/remote sensing

Abstract

This presentation discusses a pre-eminent concern of landscape level watershed management and introduces a tool developed to foster cost-effective stewardship. The need to accurately and quickly assess site potential and track ecological changes on watershed scale rangelands exists in all terrestrial ecosystems. The focus of this presentation links traditional riparian and water quality assessments techniques with existing remote sensing technology in order to assist with decision support with management of large watersheds. Moreover, its implementation can promote both environmental enhancement and improved profitability of economically sustainable rangeland businesses. This system offers a powerful new approach for yielding actionable information over large areas at low cost.

Eighty-three years of vegetation change on the TGB Osborn Vegetation Reserve, Koonamore

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Keywords: Koonamore; monitoring; video

Abstract

The TGB Osborn Vegetation Reserve, Koonamore, was established in 1925 to record the changes in vegetation of a chenopod shrubland as the land recovered from severe stocking pressure. Permanent quadrats, photopoints and transects have recorded changes over 83 years to the present. Sheep were removed from the reserve, but rabbits, though initially suppressed, were not controlled for the first 50 years, and numbers were high in several periods. For the last 30 years continuous rabbit control has kept their numbers very low. There have been large changes in the vegetation in response to the changes in grazing pressure, and also rainfall events. Changes on one of the quadrats between 1926 and 2009 are presented in the form of a video, made from the photos taken at one of the permanent photopoints on the quadrat. The video shows a dramatic increase in *Atriplex* species during the first 55 years, and a more recent large increase in *Senna* species. A "time-lapse" video spanning such a long period is probably unique. Similar videos are being prepared for the many other photopoints on the Reserve.

Showcasing innovative practices - Australian Pastoral Property Innovation Manual

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Keywords: Bestprac, innovation, network

Abstract

Innovations have been an important part of agriculture in Australia, being developed by necessity to provide unique ways of simplifying tasks, saving time or improving effectiveness. Innovators often don't realise the potential value of their ideas to other producers. Hence innovations often get "trapped" and only used by the innovator business. It was this observation that led to the development of the *Australian Pastoral Property Innovation Manual*. The purpose of the manual was to profile the innovative practices of rangeland producers. For this to happen, producers had to be invited to contribute ideas. This was achieved during 2009 by contacting producers involved in the network of Bestprac groups and pastoral producer networks around Australia. The *Australian Pastoral Property Innovation Manual* is a compilation of 120 innovations from pastoral businesses in SA, Qld, NSW and WA. The process of gathering, documenting and sharing innovations has had a significant effect on the producers involved in the project. One of the significant learnings came when producers realised that many of the practices that they took for granted were actually very innovative. They were also surprised to learn that many others were not undertaking these ideas that they accepted as commonplace. The sharing of these innovations has led to increased adoption of innovation from within the pastoral industry and even implementation of innovations from other industries. This paper will explore the concept of pastoral innovation and highlight how the development of the *Australian Pastoral Property Innovation Manual* has assisted with the ongoing improvement of pastoral businesses connected to the Bestprac network.

Making a future for the rangelands: trade-offs at multiple scales

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Keywords: tradeoffs, sustainability, rangeland livelihoods, scale

Abstract

There are tradeoffs at many scales in delivering a sustainable future for the rangelands, and understanding these depends on understanding how remote areas in Australia operate with respect to climate, markets, governance and social interactions. Informed by the 'desert syndrome' analysis, here I explore three of these scales – national, regional and local – in order to show how an integrated approach at all of these is needed for a sensible resolution of the tradeoffs. At the national scale, occupying the rangelands sustainably seems an unavoidable imperative, as well as being attractive to a significant population. Such occupancy will depend on location-based livelihoods if this population is to be supported, with implications for tradeoffs related to governance and institutions. At a regional scale, the national trade-offs play out differently according to differential regional trajectories; however, these can be systematised, and will result in diverse types of rangeland natural resource managers in the future. Locally, the interplay between conservation and production is driven by the ways in which the latter disrupt the strategies that desert species have adopted to cope with the characteristics of rangeland environments. These trade-offs are now reasonably well understood and articulated for grazing but still poorly expressed for the other land uses such as tourism, wild harvest, mining and even customary harvest where population levels are high. Ultimately, these issues need to be coordinated from national to local scales, in terms of priorities for management, governance and research.

The AussieGRASS Environmental Calculator: its application in Australian grasslands

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Keywords: modelling; climate change impacts; emissions.

Abstract

The AussieGRASS Environmental Calculator is a national simulation framework for Australian grasslands. It was developed by the Department of Environment and Resource Management in Queensland in collaboration with agencies from New South Wales, South Australia, Western Australia and the Northern Territory and with funding from Land & Water Australia (LWA) through its Climate Variability in Agriculture Program (CVAP). AussieGRASS was initially developed as a tool to assess drought conditions and has been used extensively for this purpose leading to its inclusion in the Commonwealth's National Agricultural Monitoring System (NAMS – now decommissioned). This paper describes the AussieGRASS modelling framework and outlines a range of other AussieGRASS applications.

Knowledge and skills in the rangelands - a looming crisis?

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Keywords: tradeoffs, sustainability, rangeland livelihoods, scale

Abstract

The ARS is a collective of people interested in profitable enterprises, functional landscapes and resilient communities across Australia. Members will be privileged to have around 50 'leading lights' share their knowledge and ideas about aspects of these goals at the Bourke conference; information on drivers such as rain/water, desirable and undesirable plants and animals, best practice management, successful businesses and community aspirations.

We often hear that we need more information, and that's true, but I would argue that the greatest threat to the future of our rangelands is human capacity to collate, disseminate and apply the information we have (ie. experiential, traditional and scientific knowledge) to achieve the ARS's goals. This paper explores the supply and demand side of this issue, and the scale of the challenge of growing our human capital to meet current and emerging needs.

Marra Creek Waterponing Program: Rehabilitating scalded rangelands

Thompson, R.

Central West Catchment Management Authority, New South Wales Australia

Keywords: waterponing; rehabilitation; scalded; environmental; production

Abstract

A four-year program to restore scalded and bare soils in western NSW, Australia, during the 1980s has left a remarkable legacy that has since rehabilitated 30,000 hectares of severely degraded land for environmental and production outcomes. In the Marra Creek District (western NSW) around 100,000 hectares had become bare and scalded due to grazing pressure, drought, wind and water erosion. About 30,000 hectares have been rehabilitated through waterponing. Locally, the successes of the original 18 landholders saw many others in the area adopt the technique. This is largely due to the socio-economic benefits including increased wool cut, lambing percentages and farm productivity. But there are other indirect benefits of strengthened communities and a sense that land managers can pass their properties onto future generations in a better condition than it was when they received it. The original mapping of scalded country estimates that 70,000 hectares remain to be rehabilitated in the region. With strong public acceptance and support, the program is well placed to meet this challenge.

Rainpools of the rangelands: hidden diversity and episodic production

Timms, B.

Australian Wetlands and Rivers Centre, University of New South Wales, Sydney, 2052.

Keywords: diverse; productive; invertebrates

Abstract

Rangeland rainpools fill from direct heavy rain helped by local runoff and usually persist for only a few weeks or months. They are of many types including rock pools (gnammas), grassy pools and gilgai, claypans and cane grass swamps, small freshwater and saline lakes, and various treed and vegetated swamps such as Blackbox swamps. Myriads of invertebrates come and go, various crustaceans hatching from resistant eggs in the substrate and an array of insects by flying in and out. All breed prolifically so that production usually peaks early in the hydroperiod. Generally rainpools are too episodic for management issues to arise, but mosquito production and cattle pugging can be problems.

Post-fire litter accumulation under mallee canopies in south-western NSW

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² Department of Environment, Climate Change and Water, C/- Evolution and Ecology Research Centre, School of Biological, Earth and Environmental Sciences, University of New South Wales, Sydney, NSW, 2052, Australia.

Keywords: litter; mallee; fire

Abstract

Fire management is an important issue for landholders in mallee areas. Relationships between eucalypt litter fuel loads and fire intensity are well researched, but basic information on fuel re-accumulation after fire is lacking. We compared differences in litter bed size beneath mallee trees with increasing time since fire, and related tree dimensions to litter bed size across a short spectrum (3, 13 and >30 years) of time since fire. As expected, all tree and litter dimensions increased significantly with time since fire with the exception of litter density. Litter density (kg m^{-3}) was significantly greater 13 years after fire than 30 years after fire. This is likely due to changes in litter composition with increasing time since fire. Canopy area was the best predictor of litter bed area ($R^2=0.73$) and volume ($R^2 = 0.81$). Our data confirm that relationships identified between crown size and litter bed size are upheld in recently burnt mallee communities.

Rivers are more than just water: landscape, ecology, and geomorphology in rangeland management

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Keywords: rivers; geomorphology; landscape ecology

Abstract:

Geomorphology is the geology of landscape – recognising landforms, understanding the processes which create and sustain them. Geomorphology is important to rangeland management because in an arid-zone landscape, where water and nutrients are limited, the geomorphic processes which control water and sediment distribution also control ecosystems. A river is more than just the water that flows through it: a river's processes are also about how it reacts to its geologic setting, and are intertwined with hillslope and biological processes. Changes to river processes will eventually change local ecology (such as drainage incision creating desiccated floodplains). An understanding of geomorphology is critical to assessing a landscape's natural state. Management goals aiming towards a pre-European ideal presume some knowledge of what that state was. However, assessments based on recognising landform elements, without understanding their formative processes, can lead to misinterpretation. For example, bank erosion or tree undercutting is almost universally regarded as a sign of degradation – but in meandering rivers, channel migration necessarily requires outer-bank erosion. It is not damage needing repair, it is a process that needs room to move. Geomorphology can be used to design appropriate rehabilitation works. Early river managers “fixed” the Murray by taking out the snags; now, with better understanding of river process, the snags are going back in. Once floods were regarded as a waste of water, but now they are known to be important for regenerating higher-level floodplain ecology. In the same way that increased knowledge has improved river management in the Murray, a more widespread appreciation of geomorphic processes will aid rangeland management across Australia. More appropriate and better targeted rehabilitation techniques, better government-level recognition of the importance of small ephemeral creeks, better infrastructure design, more comprehensive range assessment techniques, and better funding opportunities for specific arid-zone issues should be the result of integrating geomorphology into land management. Australian arid-zone rivers and catchments are special and different: their variable flow regimes, megaflood history, high flow impedance values, inherited landscapes and unusual landforms all call for a good understanding of geomorphic process.

Contour Furrowing: Local Landscape Processes Determine Results

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²Western Catchment Management Authority, PO Box 1048 Dubbo, NSW 2830

Keywords: range rehabilitation; runoff-runoff; geomorphology

Abstract

Contour furrows act to impound rainfall runoff and create favourable situations for plant growth. In the Western Catchment (NSW), furrowing and other mechanical treatments have been used since the mid-20thC. In 2009 prior furrowing works were reviewed, using published studies, residents' observations, and geomorphic investigation of field sites. Geomorphic processes were a focus because they are fundamental to ecological permanence and (unlike vegetation surveys) independent of recent local weather. Treatments deemed successful were >10 years old, showed self-sustaining geomorphic processes and increased vegetation. Each site's natural geomorphic processes were important contributors to the furrowing outcome. Furrowing was found to be ineffective on alluvial plains. Stony gilgai sites were effective when the treatment design worked within the existing gilgai structures (especially furrow spacing and placement). Ironstone ridge sites were effective where soil permeability was re-established, with organic content a likely factor. Critical factors for success were site selection (avoiding gullied, water-starved, high-use, steep, or base-of-slope locations), treatment design (using local landscapes to determine furrow spacing and length, not furrowing stony bands in gilgai land systems), treatment installation (accurate contour placement of furrows), and post-treatment management (total grazing management is critical).

Can sustainable pasture utilisation rates be derived from commercial paddock data in the Northern Territory?

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NT Department of Resources, GPO Box 3000, Darwin NT, 0801

Keywords: utilisation rates, land condition, carrying capacity

Abstract

Sustainable pasture utilisation rates are the cornerstone of the grazing industry because they directly determine carrying capacity. To date, we have been able to determine utilisation rates only by using expensive, time-consuming grazing trials. This study successfully tested a quick, cost-effective approach based on a method used previously in Queensland that retrospectively calculates utilisation rates using station cattle records and pasture growth predictions. Our results indicate that an average utilisation rate of up to 30% appears to be sustainable in paddocks with uniform, grey cracking-clay soils on the Barkly Tableland. However, this level of utilisation negatively impacts on preferred pastures and less robust soil types.

The Ecosystem Management Understanding (EMU) pilot project: building landscape literacy using local knowledge to improve rangeland health in the Neales River Catchment of South Australia

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²Ecosystem Management Understanding (EMU) Project™, hosted by the Centralian Land Management Association, P.O. Box 8522, Alice Springs, NT 0871. hpringle@clma.com.au

Keywords: effective; landscape; management

Abstract

Despite their vast size and a declining workforce it is possible to manage pastoral leases effectively by focusing on landscape function to identify key critical areas. Natural and human-induced processes drive changes to landscapes, vegetation structure and composition, due in part to changes in soil moisture balance. Identifying these processes and their impacts (e.g. the fate and impact of raindrops) assists with the development of 'best practice' ecological and cost-effective pastoral management. The Ecosystem Management Understanding (EMU) Project™ is a holistic land management approach, which is being trialled by the South Australian Arid Lands Natural Resources Management Board (SAALNRMB). Community support for an EMU pilot project in the district was articulated through the Marla-Oodnadatta Natural Resources Management District Group. It is a way of working with natural processes rather than against them ("fitting in with", rather than "fighting" them). It was these attributes which attracted four pastoralists to be involved in the EMU pilot project in the Neales River catchment of South Australia. These pastoralists are working towards restoring the natural landscape function to improve sustainable productivity and biodiversity across a total area of over two million hectares in the arid lands of South Australia. The EMU pilot project in the Neales River catchment of South Australia has been funded by the Commonwealth's Caring for Our Country program through the South Australian Arid Lands Natural Resources Board (SAALNRMB) and the Centralian Land Management Association (CLMA).

The Western Division Newsletter – An Effective Rangelands Communication Tool

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²Department of Industry and Investment NSW, Dubbo, NSW 2830, Australia

Keywords: communication; Western Division Newsletter; extension

Abstract

Despite the availability of electronic communication technologies our experience in co-producing the Western Division Newsletter for the last five years, and the favourable comments received from landholders, indicate that this traditional format remains an effective communication tool. The growing willingness of landholders to share their knowledge through the newsletter, and continued advertising support from suppliers and pastoral businesses, support this assessment.

Using soil seed banks to guide large-scale floodplain restoration in the Macquarie Marshes

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Keywords: wetlands, regeneration, native vegetation, seed bank

Abstract

This paper describes the regeneration potential of agricultural landscapes within a temporary wetland area of the Macquarie Marshes. In each of 49 sites, plant origin (native/exotic) and α -diversity (number of species) from the soil seed bank and in-situ vegetation were used to assess potential differences in native plant regeneration for six vegetation communities (lignum, water couch, redgum, river cooba, grassland and cropping) and two land use histories (grazing and cropping). Seedling emergence counts from soil seed banks showed that cropping resulted in a significantly lower proportion of native species compared to other vegetation communities such as river cooba and native grasslands that retained some regeneration potential under grazing and limited clearing. These differences were mostly reflected in the in-situ vegetation. However, a high proportion of bare ground occurred in all cropping sites and vegetation communities suggesting that all may be susceptible to further weed invasion. We describe the implications of these results for the restoration of this wetland.

Transitions across thresholds in Western Australian grazed rangelands

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²Department of Agriculture and Food Western Australia, South Perth, WA, 6151, Australia

Keywords: state; vegetation dynamics; range monitoring

Abstract

Thresholds and transitions between states are well-accepted components of the models of range dynamics. By definition, they represent a change from one state to another that is intransient and unlikely to reverse within an acceptable management timeframe or without significant management input. While more obvious transitions include those gross changes that occurred when livestock were introduced to Australian rangelands, transitions still occur under contemporary pastoralism. We used a state-wide monitoring data set to examine transitions that have occurred in the Western Australian pastoral rangelands over approximately the last 15 years. We found examples of transitions that were desirable as well as undesirable from a pastoral perspective. Transitions differed to the extent that they represented fundamental change to ecosystem dynamics or production potential as distinct from representing no more than substantial changes in species composition. This is important because once a threshold has been crossed, both managers and regulators need to adjust to the new reality, altering management to best address the new state and altering regulatory expectations so that condition is assessed within the context of the current state and its capacity to change.

Resolving the manager's dilemma: utilizing an integrated approach to attain complementary objectives of conservation and cash flow

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Turner Enterprises Incorporated. Raton, New Mexico, USA

Keywords: management; integration; balance

Abstract

Vermejo Park Ranch is the largest of several ranching properties owned by billionaire philanthropist R. E. "Ted" Turner. By his design, its mission is to balance ecological sensitivity and economic sustainability using native species. The property manager and employees at Vermejo Park have taken this challenge seriously and now utilize an integrated approach to attain the dual objectives of conservation and cash flow. The centerpiece of this effort is a management tool and process that addresses the underlying ecological condition and history as well as the site potential and looks to influence natural processes to promote better nutrient cycling, water infiltration and flow, and target species dynamics. This presentation provides an overview of the natural resource context and challenges and current management efforts underway as well as a brief introduction to the Land Enterprise Economic Health Analysis used to preserve both environmental values and operating profits.

Biodiversity impacts of ground tank closure in southeast Australian rangelands

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Keywords: biodiversity; water point; grazing pressure

Abstract

Literature suggests that provision of artificial water through bores, dams and ground tanks has negative environmental effects through increased grazing pressure, prevention of native species regeneration and promotion of exotic species. Though some native species may benefit from increased water, other species may decline. In arid environments worldwide, few areas remain distant from water. In Australia, much water provision is through ground tanks storing diverted run-off following rainfall events. Whilst closure of tanks is a recognized means of reducing negative impacts there is reluctance to utilize this strategy. Consequently, there are few opportunities to study responses of plant and animal populations to such closures. Where tank closure has occurred in areas reserved for conservation there is a lack of data on the effects on flora and fauna. Past studies have been limited in: the range of biota incorporated; lack of landscape-scale experimental manipulation; failure to replicate treatments. Research on the University of Ballarat's 40,000 hectare arid-zone research property, Nanya, is investigating impacts of four alternative tank treatments: fencing to exclude mammalian grazers; partial tank closure by blocking of drains; complete closure with landscaping to original profile; no action. Responses of plants, mammals, birds, reptiles and ants to these treatments are being studied. Findings will help illuminate the potential for water point closure to restore balance to the surrounding landscape, an important consideration in biodiversity conservation in arid landscapes in Australia and other parts of the world.

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The impact of *Lippia* on the social-ecological systems of the Gwydir Wetlands, and Macquarie Marshes in northern NSW

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Keywords: Murray-Darling Basin; weed invasion; grazing management

Abstract

The Murray-Darling Basin is a Social-Ecological System (SES) of major importance to Australia and includes extensive wetland areas in the north western parts of New South Wales. Historical land use has been extensive grazing; during wet periods the livestock were moved out of the wetlands and moved back in as the water receded. Recent land use changes include the building of major dams for irrigation water, and this has meant a reduction in the frequency and extent of flooding, and most of the wetlands have been continually grazed. Also, machinery capable of cultivating the very heavy textured soils became available and so dryland cropping became a major enterprise. With the reduction in flooding, many of these wetland sites have been seriously degraded. In recent years *Lippia*, *Phyla canescens* (Kunth) Greene has had major impacts on parts of this SES. *Lippia* is a perennial that grows mat-like between other species of plants and may spread to produce virtually a mono-specific stand. The domestic livestock carrying capacity of the land becomes more or less zero and the conservation value of the wetlands is also dramatically decreased. Therefore, invasion of these wetlands by *Lippia* has had and will continue to have, a major impact on the future trajectory of the whole SES in terms of its resilience, adaptability and transformability.

Cyanobacteria highly active during the wet season: A long-term study at Boodjamulla National Park, north-west Queensland.

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Keywords: cyanobacterial crusts; carbon sequestration

Abstract

This research is based in far north-west Queensland at Boodjamulla National Park, a dryland savannah dominated by *Eucalyptus* and *Melaleuca* woodlands and floodplains. The interspaces between the perennial tussock grasses are dominated by cyanobacterial soil crusts. The wet season is governed by monsoonal troughs and in the dry season there is often no rain at all. This two-year project has focused on; establishing the diversity of the different crust ecosystems, net carbon uptake annually, and seasonal eco-physiological function. Crust communities can be divided into three main types: flood plain crusts dominated by *Scytonema*, *Simploca* and *Nostoc*, with abundant liverworts and some areas of moss; dry savannah and elevated crusts dominated by *Scytonema* and *Stigonema* with lichens and liverworts and; rock crusts dominated by cyanobacteria and cyanolichens. CO₂ exchange is measured with an automated cuvette system that records the CO₂ difference over three minutes on a thirty-minute cycle, continuously. Data from the first wet season has shown that CO₂ uptake by cyanobacteria is tightly linked to light intensity but at a considerable temperature range, of 23-36°C. During the wet season, ground water levels were maintained for many weeks. Throughout this time net CO₂ uptake peaked, significantly outweighing respiration. This translates to highly productive cyanobacterial crusts for almost the entire wet season. In contrast, during the dry season a series of tests showed that cyanobacterial crusts were completely inactive. This constitutes the first wide-ranging eco-physiological report on crust function of its kind. The information will provide a comprehensive daily database for the calculation net productivity on an annual basis for cyanobacterial crusts in these ecosystems.

Effects of artificial watering points on rangeland bird communities

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Keywords: birds; water; assemblages

Abstract

Provision of permanent water in Australia's rangeland regions and the subsequent effects of grazing in these habitats have altered the composition and condition of arid zone bird communities. Some species have expanded their geographic range, mainly those that are water-dependent and benefit from disturbances. In contrast, certain species that are water-independent and are sensitive to disturbance have declined throughout much of their former range. Little is known about the direct causes for these declines or what factors are driving arid zone bird assemblages. This research investigates the effects of artificial watering points and other resources on bird assemblages in the southeast Australian rangelands. This research is being carried out at the University of Ballarat's arid zone research property, "Nanya Station". Bird surveys and habitat assessments have been conducted at each of forty sites (ranging from 100 m to 6 km from AWP) on the property to investigate relationships between birds and environmental variables. Contrary to expectation, preliminary results indicate that there is no relationship between distance to AWP and bird assemblages. Further research will investigate whether other habitat variables (i.e. vegetation composition and/or structure) have an effect over the composition of rangeland avifauna.

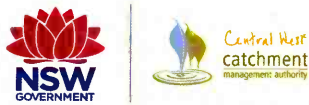


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