



# Bushfire 2016

Connecting Science, People & Practice

UNIVERSITY OF QUEENSLAND  
BRISBANE, AUSTRALIA

SEPTEMBER 28th - 30th 2016

[www.fireandbiodiversity.org](http://www.fireandbiodiversity.org)



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## Welcome to Bushfire 2016

Hosted and coordinated by the **South East Queensland Fire and Biodiversity Consortium** (SEQ Fire and Biodiversity Consortium), ***Bushfire 2016: Connecting Science, People and Practice*** is a national conference squarely aimed at connecting fire scientists, ecologists and students with onground fire operators, land managers and other fire and environmental professionals.

With a focus on applied fire research, fire management, Indigenous fire projects and collaborative fire programs, we aim to showcase successful partnerships that translate science into practice for beneficial onground fire management and environmental outcomes, whilst supporting land owners, land managers and scientists. Bushfire 2016 is a chance to engage and network with Australia's best fire scientists and onground managers – an opportunity to learn something new and build invaluable partnerships.

We have received enormous support and enthusiasm for Bushfire 2016 with ten sponsors, eight trade and promotional partners, ten themed sessions, over 70 speakers and two field trips across the three days. We would like to extend a big thank you to all our sponsors, thank you for joining us on this journey, in particular our Gold Sponsors, Fireland Consulting, Healthy Waterways and Catchments and the University of Queensland. Thank you to everyone who has encouraged and assisted along the way, including Louise Orr and the team at Healthy Waterways and Catchments; Kingfisher Creative; Abbie Glossop at the University of Queensland Union; our three inspiring Keynote Speakers; our session Chairs and all the wonderful folk who are contributing and assisting with our field trips.

We would especially like to thank our ever-supportive Organising Committee listed over the page. Your dedication, good humour, assistance and constructive advice have ensured Bushfire 2016 will be an inspiring and engaging conference and illustrate the success of collaborative partnerships. To the SEQ Fire and Biodiversity Consortium Steering Committee and partnering organisations, we wouldn't be here without you, thank you for your continued support and encouragement, we hope you enjoy Bushfire 2016. Finally, a special thank you to Associate Professor Patrick Moss at the University of Queensland, Chandra Wood of Brisbane City Council (the Chair of our Steering Committee), Melissa Walker from Healthy Waterways and Catchments and Annie Keys, without whom we would not have been able to bring Bushfire 2016 together.

It has been a privilege to coordinate Bushfire 2016 – we are sure you will leave inspired and with some new partnerships to build upon. Lastly, we hope that Bushfire 2016 leads to the resurgence of the Australasian Bushfire Conference and we put it to all attendees to consider whether their organisation would be willing to coordinate this important event in the future.

Thank you

***Dr Samantha Lloyd and Craig Welden***

**Chair and Co-Chair**

Bushfire 2016 Organising Committee

**Manager and Coordinator**

SEQ Fire and Biodiversity Consortium

## Bushfire 2016 Organising Committee

- James Haig (Queensland Fire and Emergency Services)
- Annie Keys (Keys Consulting)
- Dr Samantha Lloyd, Chair (Manager, SEQ Fire and Biodiversity Consortium)
- Dr Geoff Lundie-Jenkins (Queensland Parks and Wildlife Service)
- Steve Martin (Powerlink)
- Associate Professor Patrick Moss (University of Queensland)
- Michael Reif (Sunshine Coast Council)
- Cuong Tran (Ten Rivers)
- Melissa Walker (Healthy Waterways and Catchments)
- Craig Welden (Coordinator, SEQ Fire and Biodiversity Consortium)
- Chandra Wood (Brisbane City Council)

## Welcome from the SEQ Fire and Biodiversity Consortium

Welcome to ***Bushfire 2016: Connecting Science, People and Practice***, at the University of Queensland, Brisbane. It has been 10 years since the SEQ Fire and Biodiversity Consortium coordinated and hosted the Bushfire 2006 conference and since Australia has had a national bushfire conference and so it is with much pleasure that we bring Bushfire 2016 to you.

Bushfire 2016 is about bringing together fire scientists, ecologists and students with onground fire operators, public land managers, Indigenous fire specialists and other fire and environment professionals to share, engage, learn, partner and network. We have three world-class keynote speakers, as well as two full days of inspiring concurrent sessions planned over Wednesday and Thursday. We will be trying to make time for questions and discussions so please contribute whether it is with a question, observation or from the benefit of your own knowledge and experience. The poster session on Wednesday evening will provide an opportunity to catch up with presenters and fellow participants as will the informal dinner on Thursday evening, we hope that you have all registered for the dinner as it is going to be a great night. There will also be field trips to North Stradbroke Island and the Sunshine Coast on Friday that are brought to you by collaborations across multiple stakeholders to best illustrate the partnerships and outcomes we try to encourage and showcase at the SEQ Fire and Biodiversity Consortium.

It will be a very busy three days and we hope that you take the opportunity to connect with others in the dynamic field of bushfire knowledge, understanding, planning and practice. On behalf of the SEQ Fire and Biodiversity Consortium Steering Committee, a final mention needs to go to the tireless efforts of Dr Samantha Lloyd and Craig Welden of the SEQ Fire and Biodiversity Consortium for making this Conference a reality and the support given to them by Healthy Waterways and Catchments.

Welcome and enjoy!

**Chandra Wood**

**Chair, Steering Committee**

SEQ Fire and Biodiversity Consortium

**Senior Co-ordinator Natural Environment**

Brisbane City Council

## About the SEQ Fire and Biodiversity Consortium

Established in 1998, the primary aim of the SEQ Fire and Biodiversity Consortium is to *translate science into practice for improved fire management and biodiversity conservation in south east Queensland*. The SEQ Fire and Biodiversity Consortium is a network of land managers and stakeholders devoted to providing a coordinated response and best-practice recommendations for fire management, fire ecology and biodiversity conservation in south east Queensland through knowledge brokering, stakeholder engagement, supporting research, building partnerships, training and other resources.

The SEQ Fire and Biodiversity Consortium has three priority areas of delivery:

1. Education and engagement - assisting land managers and private land holders with practical information on fire management and biodiversity conservation;
2. Applied research - supporting fire research investigating knowledge gaps in fire ecology and management; and
3. Representation and response - provision of coordinated responses to matters of significant fire management and fire ecology importance.

The SEQ Fire and Biodiversity Consortium is supported by 19 enthusiastic and dedicated stakeholder organisations. A Steering Committee chaired by Brisbane City Council guides and supports staff work priorities. The SEQ Fire and Biodiversity Consortium gratefully acknowledges support from the following organisations and in particular would like to recognise Heathy Waterways and Catchments (formerly SEQ Catchments), who have generously hosted the SEQ Fire and Biodiversity Consortium since July 2010. This impressive list of 19 supporting organisations reflects the broad support the SEQ Fire and Biodiversity Consortium receives in SEQ and demonstrates its active and dedicated membership:

- Brisbane City Council
- City of Gold Coast
- Department of Transport and Main Roads (Southern Downs Region)
- Heathy Waterways and Catchments
- Ipswich City Council
- Lockyer Valley Regional Council
- Logan City Council
- Moreton Bay Regional Council
- Powerlink
- Queensland Fire and Emergency Services (Brisbane Region)
- Queensland Parks and Wildlife Services
- Redland City Council
- Rural Fire Service Queensland
- Scenic Rim Regional Council
- Seqwater
- Somerset Regional Council
- South Burnett Regional Council
- Sunshine Coast Council
- Toowoomba Regional Council

For further information please visit: [www.fireandbiodiversity.org.au](http://www.fireandbiodiversity.org.au)



## Thank you to our Sponsors

### GOLD SPONSORS



### SILVER SPONSORS



## Thank you to our Sponsors

### BRONZE SPONSORS



### EXHIBITORS AND PROMOTIONAL SPONSORS



## Program Overview

### Tuesday 27<sup>th</sup> September

1500 - 1800	<b>Registration:</b> Aung San Suu Kyi Conference Centre, Union Complex Building 21C (Union Complex, Building 21C)
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### Wednesday 28<sup>th</sup> September

0700 - 1050	<b>Registration</b>
0845 - 1020	<b>PLENARY SESSION:</b> Abel Smith Lecture Theatre (Building 23) Chair: Dr Samantha Lloyd (SEQ Fire and Biodiversity Consortium)
0845	<b>Welcome to Country:</b> Shannon Ruska, Founder and Director of the Nunukul Yuggera Aboriginal Dance Troupe
0855	<b>Welcome and Opening</b>
0910	<b>Opening Address:</b> Professor Hugh Possingham, School of Biological Sciences, University of Queensland
0930	<b>Keynote Presentation:</b> Professor Ross Bradstock, Centre for Environmental Risk Management of Bushfires, University of Wollongong. <i>A tale (mostly) of one city: toward a comprehensive understanding of bushfire risks, present and future.</i>
1020 - 1050	<b>Morning Tea: Union Complex, Building 21C</b> <i>Please note: it takes approximately 5mins to walk from the Union Complex to the Prentice Building (Bld 42) and the Physiology Lecture Theatre (Bld 63).</i>
1050 - 1300	<b>THEME 1: Fire and Risk, Prentice Bld (Bld 42) Room 216.</b> Chair: Andrew Sturgess (Qld Fire and Emergency Services)  <b>THEME 2: Cultural Burning and Traditional Custodian Fire Projects,</b> <i>Bld 23, Abel Smith Lecture Theatre.</i> Chair: Oliver Costello (University of Technology Sydney, NSW)  <b>THEME 3: Community Engagement: Building Partnerships and Facilitating Change,</b> <i>Bld 63, Physiology Lecture Theatre, Rm 348.</i> Chair: Craig Welden (SEQ Fire and Biodiversity Consortium, Qld)
1300 - 1400	<b>Lunch: Union Complex, Building 21C</b>
1400 - 1450	<b>PLENARY SESSION:</b> Abel Smith Lecture Theatre, Building 23. Chair: Chandra Wood (Brisbane City Council)  <b>Keynote Presentation:</b> Dr Neil Burrows, Science and Conservation Division, Department of Parks and Wildlife, Western Australia. <i>Managing fire in the new millennium</i>
1600 - 1630	<b>Afternoon Tea: Union Complex, Building 21C</b>
1630 - 1730	<b>THEME 1 continued: Fire and Risk, Prentice Bld (Bld 42) Room 216.</b> Chair: Cuong Tran (Ten Rivers)  <b>THEME 2 continued: Cultural Burning and Traditional Custodian Fire Projects,</b> <i>Bld 23, Abel Smith Lecture Theatre.</i> Chair: Oliver Costello (University of Technology Sydney, NSW)  <b>THEME 4 continued: Fire Ecology, Bld 63, Physiology Lecture Theatre, Rm 348.</b> Chair: Dr Penny Watson (Office of Environment and Heritage)
1745	<b>TRADE DISPLAY and POSTER SESSION: Union Complex, Building 21C</b> (Light refreshments provided)



## Thursday 29th September

0700 - 1040	<b>Registration:</b> Union Complex, Building 21C
0845 -1010	<b>PLENARY SESSION:</b> Abel Smith Lecture Theatre, Building 23 Chair: Dr Samantha Lloyd (SEQ Fire and Biodiversity Consortium)
0845	<b>Welcome and Opening</b>
0900	<b>Opening Address:</b> Acting Deputy Commissioner, Peter Jeffrey, Emergency Services Volunteers, Queensland Fire and Emergency Services
0920	<b>Keynote Presentation:</b> Associate Professor Alan York, School of Ecosystem and Forest Sciences, University of Melbourne. <i>Fire, landscape pattern and biodiversity</i>
1010 - 1040	<b>Morning Tea: Union Complex, Building 21C</b>
1040 – 1250	<b>THEME 5: Fire, Soil and Climate Change</b> , <i>Prentice Bld (Bld 42) Room 216</i> . Chair: Dr Tom Lewis ( <i>Departments of Agriculture and Fisheries</i> ) <b>THEME 6: Maps and Models: Intelligent Fire Planning</b> , <i>Bld 23, Abel Smith Lecture Theatre</i> . Chair: Joshua Bull ( <i>Fireland Consultancy</i> ) <b>THEME 7: Fire Management for Linear Infrastructure</b> , <i>Bld 63, Physiology Lecture Theatre, Rm 348</i> . Chair: Steve Martin ( <i>Powerlink</i> )
1250 - 1335	<b>Lunch: Union Complex, Building 21C</b>
1335 - 1450	<b>PLENARY SESSION:</b> Abel Smith Lecture Theatre, Building 23. Chair: Dr Simon Heemstra ( <i>Rural Fire Service, NSW</i> ) <b>Panel Discussion:</b> Intelligent Fires - how can fire research and knowledge better connect with drip torches?
1450 - 1550	<b>THEME 8: Fire and Land Management</b> , <i>Prentice Bld (Bld 42) Room 216</i> . Chair: Michael Reif ( <i>Sunshine Coast Council</i> ) <b>THEME 9: Fire, Threatened Species and Conservation</b> , <i>Bld 23, Abel Smith Lecture Theatre</i> . Chair: Dr Geoff Lundie-Jenkins ( <i>Qld Parks and Wildlife Service</i> ) <b>THEME 10: Fire in the Past: Essential Knowledge for Management</b> , <i>Bld 63, Physiology Lecture Theatre, Rm 348</i> . Chair: Associate Professor Patrick Moss ( <i>University of Queensland</i> )
1550 - 1620	<b>Afternoon Tea: Union Complex, Building 21C</b>
1620 - 1735	<b>THEME 8 continued: Fire and Land Management</b> , <i>Prentice Bld (Bld 42) Room 216</i> . Chair: Michael Reif ( <i>Sunshine Coast Council</i> ) <b>THEME 9 continued: Fire, Threatened Species &amp; Conservation</b> , <i>Bld 23, Abel Smith Lecture Theatre</i> . Chair: Dr Geoff Lundie-Jenkins ( <i>Qld Parks and Wildlife Service</i> ) <b>THEME 10 continued: Fire in the Past: Essential Knowledge for Management</b> , <i>Bld 63, Physiology Lecture Theatre, Rm 348</i> . Chair: Associate Professor Patrick Moss ( <i>University of Queensland</i> )
1740 - 1755	<b>CLOSING SESSION:</b> Abel Smith Lecture Theatre, Bld 23 Chairs: Dr Samantha Lloyd and Craig Welden (SEQ Fire and Biodiversity Consortium)
1800 - 1815	<b>Bar open to purchase pre dinner drinks</b> <b>Bushfire 2016 Dinner: Union Complex, Building 21C</b>

## Friday 30th September

0620 - 1700	<b>Field Trip 1: North Stradbroke Island</b>
0800 - 1600	<b>Field Trip 2: Sunshine Coast</b>

**Notes:** The program may undergo minor changes. (S) = Student Presentation

## Opening Address

### Professor Hugh Possingham, University of Queensland Wednesday 28th September, 2016

**Professor Hugh Possingham, an Australian Research Council Federation Fellow, is Professor of Mathematics and Professor of Ecology at The University of Queensland.**

Hugh also has a variety of broader public roles advising policy makers, conservation groups and managers by sitting on 15 committees and boards outside the University of Queensland including: The Wentworth Group of Concerned Scientists (founding member), founding editor of Conservation Letters (an international scientific journal) and several Environmental NGO scientific advisory committees. He and Dr Barry Traill wrote "The Brigalow Declaration", used by Premier Beattie to halve land clearing in Queensland thereby reducing greenhouse gas emissions in Australia by more than 5% per annum and saving an area the size of Portugal from conversion into farmland.

The Possingham lab uses mathematics to formulate and solve problems for saving plants, animals and ecosystems. They developed the most widely used conservation planning software in the world. Marxan [www.ecology.uq.edu.au/marxan.htm](http://www.ecology.uq.edu.au/marxan.htm) was used to underpin the rezoning of the Great Barrier Reef and is currently used in over 150 countries by over 6000 users – from the UK and USA to Madagascar and Brazil – to build the world's marine and terrestrial landscape plans.

From Nov 14th 2016 Hugh will be The Chief Scientist of The Nature Conservancy (world's largest conservation environmental NGO with 3500 staff in 37 countries globally) moving regularly between Washington DC and Brisbane.



## Acting Deputy Commissioner Peter Jeffery, Queensland Fire and Emergency Services

**Thursday 29th September, 2016**

**Acting Deputy Commissioner Jeffery's substantive role is as Assistant Commissioner, State Emergency Service, a role he undertaken since October 2013 and was previously appointed to the position of Director, State Emergency Service Management in 2011.**

Prior to joining the State Emergency Service Peter had a distinguished career in the Army and Army Reserve both in Australia and on numerous overseas deployments.

In recognition of his work during deployments Peter was awarded the Conspicuous Service Cross in the 2001 Queen's Birthday Honours and the United States Meritorious Service Medal for his leadership and cooperation with the Multi-National Force-Iraq. Throughout this time, Peter was also employed by the Queensland Police Service to work in the Academy's Management Development Program and the Counter-Terrorism Strategic Policy Unit.

In 2008, Peter was appointed as the Executive Director of the Asia Pacific Centre for Military Law and as a Brigadier in the Army Reserve, was appointed to command the 11th Brigade. The 11th Brigade provided Defence assistance throughout Queensland during the 2011 Floods and Cyclone Yasi. In the Queen's Birthday Honours of 2011, Peter was appointed as a Member of the Order of Australia for his command of 11th Brigade.



## Welcome to Country

### Shannon Ruska

#### Founder and Director - Nunukul Yuggera Aboriginal Dance Troupe

Shannon Ruska is a descendant of the Yuggera and Turbul people of the Brisbane, Logan Ipswich Regions, the Nunukul and Nugi people of Stradbroke and Moreton Islands and the Koombamerri people of the Gold Coast area.

Shannon has been performing since the age of 8. He is one of the founders and Directors of the internationally acclaimed Nunukul Yuggera Aboriginal Dance Troupe (established in 1995), which prides itself as being one of the leading Aboriginal dance groups in Australia. The Troupe has won the Queensland Tourism Award for three consecutive years and travelled the world extensively, performing alongside some of the world's greatest performers and cultural ambassadors showcasing Traditional Aboriginal culture. Shannon has shown great choreographic ability through traditional and contemporary arts performance. He was a Guest Curator for Queensland Performing Art Company's Cultural Production - Clansectry in 2016. He has performed many Welcome to Country ceremonies at a number of prestigious events such as the G20 Brisbane World Leaders Summit 2014 and the World Rainforest Festival, Borneo 2013.

## Keynote Speakers

### Professor Ross Bradstock

#### Director - Centre for Environmental Risk Management of Bushfires, University of Wollongong, New South Wales

Professor Ross Bradstock is a leading, widely cited researcher in fire ecology with over 150 journal papers and book chapters and 6 books on fire ecology, biodiversity and management, plus more than thirty major scientific reports and policy documents. Recent invited research collaborations include Australian Government (Department of climate Change and Energy Efficiency) and NCCARF reviews on impact of climate change on fire



regimes, fuels, biodiversity and fire management (2008-2012), ARC Network for Vegetation Function Working Groups (2007-2010), USGS Natural Hazards Program (2009-2013), ACEAS Pyrogeography Working Group on fire and climate change (2011-12), NCEAS working group on evolutionary ecology of fire. Recent invited international conference presentations include, INTECOL (2009), AGU (2010), MEDECOS (2011), EGU (2012) and ICFBR (2015). He leads a multi-disciplinary research team that is dedicated to the development of a quantitative understanding of risks posed by landscape fires to multiple values and the way such risks may be altered through cost-effective management and global change. Major funding sources for his team and other collaborations include ARC, NSW Environmental Trusts, NSW Government, CSIRO, Bushfire and Natural Hazards CRC, USGS and the European Union. For further information visit: <http://smah.uow.edu.au/biol/contacts/UOW057162.html>

## Dr Neil Burrows

**Senior Principal Research Scientist - Department of Parks and Wildlife, Western Australia**

Since graduating from ANU in 1977, Dr Burrows (Neil) has worked as an applied bushfire scientist, fire policy and fire management advisor, and science director with the Western Australian Department of Parks and Wildlife and its predecessors. His diverse research themes include fire behaviour and fire ecology in a range of ecosystems including eucalypt forests, woodlands and softwood plantations in south-west Western Australia and spinifex grasslands in the Western Desert. In 1994, he completed a PhD on modelling the behaviour and some impacts of fire in jarrah forests. Neil also has experience in fire management planning and prescribed burning, and during summer, participates in bushfire suppression as part of a pre-formed Incident Management Team. He is an experienced bushfire investigator and assists with incident reviews, inquiries and legal processes following significant bushfires. Neil is an Adjunct Professor, Faculty of Natural and Agricultural Science, at the University of Western Australia. For further information visit: [www.dpaw.wa.gov.au/](http://www.dpaw.wa.gov.au/)



## Associate Professor Alan York

**Head - Fire and Biodiversity Research Program, School of Ecosystem and Forest Sciences, University of Melbourne, Victoria**

Associate Professor Alan York (Alan) leads the Fire Ecology and Biodiversity research program within the School of Ecosystem and Forest Sciences at the University of Melbourne. His research group, based at Creswick, is currently investigating how fire causes patterns in the landscape, and how plants and animals respond to these patterns. They are researching how land managers might use planned fire to develop mosaics of post-fire age classes in space and time, and how biodiversity responds to these mosaics. Alan has been involved in applied fire ecology research for over 30 years; working primarily in universities and State research agencies in NSW and Victoria.

His research interests are varied, but he has a particular interest in the ecology and conservation of insects and other invertebrates, and their roles in nutrient cycling and ecosystem function. For further information please visit: <http://www.fireecologyandbiodiversity.com/or> <https://ecosystemforest.unimelb.edu.au/research/research-themes/ecosystem-and-landscape-management/fire-ecology-and-biodiversity/research>



## Panel Discussion

### Intelligent Fire: How can fire research and knowledge better connect with drip torches?

**Chair:** Dr Simon Heemstra (Rural Fire Service, NSW)

Bushfires are a uniting force within Australian communities and in an ever-increasing peri-urban zone, land managers and community often seek a balance between land management, biodiversity values & fire management. To further exacerbate the challenge, dangerous bushfire weather is predicted to worsen with climate change, placing landowners, land managers and firefighting services under increasing pressure to improve land and fire management (Climate Council, 2015). Add to this many ecosystems and species at risk due to inappropriate fire regimes (both too little and too much fire) and we are faced with a monumental challenge.

Fortunately, Australia has a wealth of world-class fire scientists to contribute to a solution and a plethora of highly skilled onground fire operators and managers. But...how well do these two groups work together? How effective are we at communicating and sharing this information in formats useable by land managers. Moreover, with a great many knowledgeable and skilled Indigenous fire specialists, how well do we partner with Traditional Owners to better tackle fire and land management challenges? Finally, how well do we partner with private landowners, who manage the vast majority of Australian bushland? There is an enormous amount of research and knowledge available but communication is not always "fit for purpose" and certainly there is inconsistency in how this information is shared and used. In this panel discussion we're going to look at some of the key barriers to communicating and sharing fire science, what sort of information land managers would like to see and how to build effective multi-stakeholder partnerships.

We are very fortunate to have Dr Simon Heemstra (Manager Community Planning, NSW Rural Fire Service) as Chair of the panel and joining him are the following world-class fire specialists:

- Mick Blackman, Managing Director, Friendly Fire Ecological Consultants, Qld.
- Oliver Costello, Co-founder of the Firesticks Initiative and Visiting Fellow at Jumbunna Indigenous House of Learning, University of Technology Sydney, NSW.
- Dr Malcolm Gill, OAM, CSIRO, retired fire ecologist, Fenner School of Environment and Society, Australian National University, ACT.
- Dr John Kanowski, National Science and Conservation Manager, Australian Wildlife Conservancy, Qld.
- Dr Richard Thornton, Chief Executive Officer, Bushfire and Natural Hazards CRC, Vic.
- Dr Elizabeth Tasker, Principal Scientist Fire Ecology, NSW Office of Environment and Heritage, NSW.

We encourage you to submit your questions in advance if you wish and contribute to a lively and engaging discussion on this important topic.



## Bushfire 2016: Full Program

### Tuesday 27<sup>th</sup> September

<b>1500 - 1800</b>	<b>Registration:</b> Aung San Suu Kyi Conference Centre, Union Complex Building 21C (Union Complex, Building 21C)
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### Wednesday 28<sup>th</sup> September

<b>0700 - 1050</b>	<b>Registration</b>		
<b>0845 - 1020</b>	<b>PLENARY SESSION:</b> Abel Smith Lecture Theatre (Building 23) Chair: Dr Samantha Lloyd (SEQ Fire and Biodiversity Consortium)		
<b>0845</b>	<b>Welcome to Country:</b> Shannon Ruska, Founder and Director of the Nunukul Yuggera Aboriginal Dance Troupe		
<b>0855</b>	<b>Welcome and Opening</b>		
<b>0910</b>	<b>Opening Address:</b> Professor Hugh Possingham, School of Biological Sciences, University of Queensland		
<b>0930</b>	<b>Keynote Presentation:</b> Professor Ross Bradstock, Centre for Environmental Risk Management of Bushfires, University of Wollongong. <i>A tale (mostly) of one city: toward a comprehensive understanding of bushfire risks, present and future.</i>		
<b>1020 - 1050</b>	<b>Morning Tea: Union Complex, Building 21C</b> <i>Please note: it takes approximately 5mins to walk from the Union Complex to the Prentice Building (Bld 42) and the Physiology Lecture Theatre (Bld 63).</i>		
<b>1050 - 1300</b>	<b>THEME 1: Fire and Risk,</b> <i>Prentice Bld (Bld 42) Room 216.</i> Chair: Andrew Sturgess (Queensland Fire and Emergency Services)	<b>THEME 2: Cultural Burning and Traditional Custodian Fire Projects,</b> <i>Bld 23, Abel Smith Lecture Theatre.</i> Chair: Oliver Costello (University of Technology Sydney, NSW)	<b>THEME 3: Community Engagement: Building Partnerships and Facilitating Change,</b> <i>Bld 63, Physiology Lecture Theatre, Rm 348.</i> Chair: Craig Welden (SEQ Fire and Biodiversity Consortium, Qld)
	Holistic bushfire management at a continental scale: Achieving consistency and improvements <b>Cuong Tran</b> <i>Ten Rivers, Qld</i>	Cultural Pathways of Fire <b>Oliver Costello</b> <i>Co-founder of the Firesticks Initiative and Visiting Fellow, University of Technology Sydney, NSW</i>	Connecting Community and Koala using Phoenix Rapid Fire <b>Phillip Patterson</b> Rural Fire Service, NSW
	Wye River Learnings and Recovery <b>Justin Leonard</b> <i>CSIRO, Vic</i>	Fire Planning for the Katiti Petermann IPA: Family Fire Country <b>Jane Blackwood, Tracey Guest, Selina Kulitja Bernard Bell and Raymond James</b> <i>Central Lands Council, NT</i>	Landholders linking through Landcare for landscape fire planning in the Queensland Murray Darling Basin for carbon, production and biodiversity <b>Rhonda Toms-Morgan, Col Paton, Peter Thompson, Lynda Hardwick, Roxane Blakley and Donna Hurley</b> <i>Queensland Murray Darling Committee and EcoRich Grazing, Qld</i>

	SABRE Fire - A Stochastic Simulation-based Fire Spread Decision Support System <b>Ben Twomey</b> <i>Queensland Fire and Emergency Services, Qld.</i>	Cultural fire landscapes on North Stradbroke Island (Minjerribah) <b>Dave Kington, Darren Burns and Dr Paul Williams</b> <i>Queensland Parks and Wildlife Service, Quandamooka Yoolooburrabee Aboriginal Corporation and Vegetation Management Science, Qld</i>	Capacity Building in the Surat Basin <b>Murray Abel</b> <i>Powerlink, Qld</i>
	Managing ecological risks in prescribed burning <b>Wayne Kington and Adrian Pyrke</b> <i>Australian Fire and Emergency Service Authorities Council, Vic</i>	Winba = Fire: Developing a fire & seasons calendar for Wattleridge IPA <b>Michelle McKemey and Lesley Patterson</b> <i>University of New England and Banbai Employment Development Aboriginal Corporation, NSW</i>	CFA Fire-Scape: Social factors in Community Fire Management <b>Mike McStephen</b> <i>Wellington Shire Council, Vic</i>
	Implementing a Risk Based Approach to Fire Management in Victoria <b>Frazer Wilson</b> <i>Department of Environment, Land, Water and Planning, Vic</i>	Minyumai Rangers use fire and burning to convert a long-grazed & weed dominated clearing back into coastal forested wetland vegetation <b>Daniel Gomes, Marcus Ferguson, Justin Gomes, Daniel Wilson, Belinda Gomes, Emma Wilson, Kesha Wilson and Lilly Wilson</b> <i>Minyumai Land Holding Aboriginal Corporation and Ngunya Jargoan Indigenous Protected Area, Jali Local Aboriginal Land Council, NSW</i>	Can citizens accurately report on fuel hazard? <b>Dr Ernst Kemmerer and Mark Wisniewski</b> <i>Cradle Coast NRM, Tas</i>
	The application of economics in US wildfire management <b>Dr Tyron Venn*, David Calkin and Matt Thompson</b> <i>University of the Sunshine Coast*, Qld and the USDA Forest Service, Rocky Mountain Research Station, USA</i>	Fusing 'Tech' and 'TEK': Queensland's Cape, fire and forging partnerships <b>Janie White and Les Harrigan</b> <i>Queensland Parks and Wildlife Service and Rinyirru Land Trust Corporation, Qld</i>	Building Partnerships and Facilitating Change for Improved Fire Management: The SEQ Fire and Biodiversity Consortium Model <b>Craig Welden. SEQ</b> <i>Queensland Fire and Biodiversity Consortium, Qld</i>
<b>1300 - 1400</b>	<b>Lunch: Union Complex, Building 21C</b>		
<b>1400 - 1450</b>	<b>PLENARY SESSION:</b> Abel Smith Lecture Theatre, Building 23. Chair: Chandra Wood (Brisbane City Council)		
	<b>Keynote Presentation:</b> Dr Neil Burrows, Science and Conservation Division, Department of Parks and Wildlife, Western Australia. <i>Managing Fire in the New Millennium.</i>		



<b>1450 - 1550</b>	<b>THEME 1 continued:</b> <b>Fire and Risk</b> , <i>Prentice Bld (Bld 42) Room 216.</i> Chair: Cuong Tran (Ten Rivers)	<b>THEME 2 continued:</b> <b>Cultural Burning and Traditional Custodian Fire Projects</b> , <i>Bld 23, Abel Smith Lecture Theatre</i> Chair: Oliver Costello (University of Technology Sydney, NSW)	<b>THEME 4: Fire Ecology</b> , <i>Bld 63, Physiology Lecture Theatre, Rm 348</i> Chair: Dr Penny Watson (Office of Environment and Heritage)
	QFES Predictive Services Team: Planning, preparedness, response and recovery <b>Andrew Sturgess</b> <i>Queensland Fire and Emergency Services, Qld</i>	Fire management on the Western Cape: Tradition, science and building economic opportunity <b>Gavin Kendall, Eddie Kendall and Peter Barker</b> <i>Pormpuraaw Aboriginal Shire Council and Queensland Indigenous Land and Sea Ranger Program, Qld</i>	Evidence for bark thickness as a fire resistance trait from desert to savanna in fire-prone inland Australia <b>Professor Mike Laves and Dr Catherine Nano</b> <i>Charles Darwin University and The Department of Land Resource Management, NT</i>
	Investigating issues of implementing a strategic tenure-blind prescribed burning program in South Australia <b>Tim Groves</b> <i>Department of Environment, Water and Natural Resources, SA</i>	People, fire and landscape in the Bunya Mountains <b>Mick Smith</b> <i>Bunya Murri Rangers, Qld</i>	Tracking recovery and vital attributes of flora species after severe wildfire, Warrumbungle National Park, north-western NSW <b>Dr Penny Watson and Dr Elizabeth Tasker</b> <i>Office of Environment and Heritage, NSW</i>
	Mechanical Fuel Load Reduction Trials <b>Dr Fabiano Ximenes and John Samuel</b> <i>Department of Primary Industry, NSW</i>	Cultural fire management on the Sunshine Coast for the first time since traditional times <b>Kerry Jones and Susie Chapman</b> <i>Bunya Bunya Country Aboriginal Corporation and Healthy Waterways and Catchments, Qld</i>	Fire effects on pollinators and pollination <b>Julian Brown (S) and Associate Professor Alan York</b> <i>University of Melbourne, Vic</i>
<b>1600 - 1630</b>	<b>Afternoon Tea: Union Complex, Building 21C</b>		
<b>1630 - 1730</b>	<b>THEME 1 continued:</b> <b>Fire and Risk</b> , <i>Prentice Bld (Bld 42) Room 216.</i> Chair: Cuong Tran (Ten Rivers)	<b>THEME 2 continued:</b> <b>Cultural Burning and Traditional Custodian Fire Projects</b> , <i>Bld 23, Abel Smith Lecture Theatre.</i> Chair: Oliver Costello (University of Technology Sydney, NSW)	<b>THEME 4 continued:</b> <b>Fire Ecology</b> , <i>Bld 63, Physiology Lecture Theatre, Rm 348.</i> Chair: Dr Penny Watson (Office of Environment and Heritage)

	Factors driving flammability in the mountainous forests of Victoria <b>Dr Jane Cawson, Dr Thomas Duff, Dr Trent Penman and Associate Professor Kevin Tolhurst</b> <i>University of Melbourne, Vic</i>	Preliminary results from monitoring the responses of vertebrate groups to applying contemporary indigenous burning practices in northern NSW IPAs <b>David Milledge</b> <i>Landmark Ecological Services, NSW</i>	Long-term effects of frequent fire on above-ground carbon stocks and vegetation structure in a wet sclerophyll forest in south-east Queensland <b>Dr Tom Lewis and Professor Chenrong Chen</b> <i>Department of Agriculture and Fisheries and Griffith University, Qld</i>
	Law for Resilience to Bushfire in peri-urban Australia: A Tasmanian Case Study <b>Joseph Wenta (S), Professor Jan McDonald and Dr Jeffrey McGee</b> <i>University of Tasmania, Tas</i>	Ornithogenic fire – Birds as propagators of fire in the Australian savanna <b>Bob Gosford and Associate Professor Mark Bonta</b> <i>Ethnoornithology Research Group and Penn State University, USA</i>	Fire ecology of Brisbane's eucalypt forests <b>Dr Paul Williams, Dave Kington, Michelle Nash, Chandra Wood and Eleanor Collins</b> <i>Vegetation Management Science, Queensland Parks and Wildlife Service and Brisbane City Council, Qld</i>
	Navigating asset protection and biodiversity conservation objectives associated with fire management in Dry Sclerophyll Forest, City of Gold Coast. <b>Brooke Williams (S), Associate Professor Kerrie Wilson, Dr Luke Shoo and Dr Hawthorne Beyer</b> <i>University of Queensland, Qld</i>	The Angel in the detail - diverse burning for cultural and environmental outcomes in Australia <b>Peta-Marie Standley 1, Lewis Musgrave 2</b> <i>1 James Cook University and Cape York Natural Resource Management 2 Awu Laya Kuku Thaypan Green Army, Qld</i>	Vegetation boundary dynamics and relationships between fire severity and recruitment in a fire-sensitive heathland in the Gibson Desert <b>Boyd Wright</b> <i>Northern Territory Herbarium, NT</i>
1745	TRADE DISPLAY and POSTER SESSION: Union Complex, Building 21C (Light refreshments provided)		

Thursday 29th September

0700 - 1040	<b>Registration:</b> Aung San Suu Kyi Conference Centre, Union Complex Building 21C (Union Complex, Building 21C)		
0845 - 1010	<b>PLENARY SESSION:</b> Abel Smith Lecture Theatre, Building 23 Chair: Dr Samantha Lloyd (SEQ Fire and Biodiversity Consortium)		
0845	<b>Welcome and Opening</b>		
0900	<b>Opening Address:</b> Acting Deputy Commissioner, Peter Jeffrey, Emergency Services Volunteers, Queensland Fire and Emergency Services		
0920	<b>Keynote Presentation:</b> Associate Professor Alan York, School of Ecosystem and Forest Sciences, University of Melbourne. <b><i>Fire, landscape pattern and biodiversity</i></b>		
1010 - 1040	<b>Morning Tea: Union Complex, Building 21C</b>		
1040 - 1250	<b>THEME 5: Fire, Soil and Climate Change, Prentice Bld (Bld 42) Room 216.</b> Chair: Dr Tom Lewis (Department of Agriculture and Fisheries)	<b>THEME 6: Maps and Models: Intelligent Fire Planning, Bld 23, Abel Smith Lecture Theatre.</b> Chair: Joshua Bull (Fireland Consultancy)	<b>THEME 7: Fire Management for Linear Infrastructure, Bld 63, Physiology Lecture Theatre, Rm 348.</b> Chair: Steve Martin (Powerlink)

Comparing smoke pollution from prescribed and wildfires: do we have a problem? <b>Dr Owen Price, Bronwyn Horsey and Phil Purdam</b> <i>University of Wollongong and the Bureau of Meteorology, NSW</i>	Can thermal imagery help inform landscape fire management and planning? <b>Shannon Mooney and Mik Petter</b> <i>Healthy Waterways and Catchments, Qld</i>	Lines Through the Bush' - Infrastructure Corridors and Fire Management: An SEQ Case Study and Factors to Consider <b>Dr Mark Shuster and Paul Veivers</b> <i>Meandu Mine, Qld</i>
Combating wetland burning – The ability of carbonate to suppress combustion of organic soils <b>Valerie Densmore</b> <i>Department of Parks and Wildlife, WA</i>	TERN: Data Infrastructure that enables fire management <b>Associate Professor Nikki Thurgate, Dr Siddeswara Guru and Professor Tim Clancy</b> <i>Terrestrial Ecosystem Research Network and the University of Queensland, Qld</i>	The Coordinated Agency Model for Improved Roadside Fire Management <b>Julian Selke and James Haig</b> <i>Department of Transport and Main Roads and the Queensland Fire and Emergency Services, Qld</i>
Interactive relationships between fire frequency, insects and elemental cycling in Peachester State Forest <b>Orpheus Butler (S), Professor Chenrong Chen, Professor Brendan Mackey, Dr Tom Lewis and Professor James J. Elser</b> <i>Griffith University and the Department of Agriculture and Fisheries, Qld</i>	Science in practice: application of ecological metrics in strategic bushfire management planning <b>Imogen Fraser and Andrew Blackett</b> <i>Department of Environment, Land, Water and Planning, Vic</i>	Corridor fires: What's different? <b>Dr Leasia Felderhof</b> <i>Firescape Science, Qld</i>
Environmental determinants of grass and shrub cover across a transitional climate region: Implications of climate change on fuel dynamics <b>Dr Rebecca Gibson and Professor Ross Bradstock</b> <i>Office of Environment and Heritage and the University of Wollongong, NSW</i>	Modelling optimal growth stage distributions for biodiversity observation and ecosystem resilience <b>Matthew Chick (S) and Associate Professor Alan York</b> <i>University of Melbourne, Vic</i>	Mahogany Glider movements near linear infrastructure <b>Ben Saal</b> <i>Powerlink, Qld</i>
Estimating air emissions for natural fires in south east Queensland <b>Rhiannon Tooker and Robin Smit</b> <i>Department of Science, Information Technology and Innovation, Qld</i>	Fire is not fire – The next generation of TERN fire remote sensing datasets <b>Stefan Maier</b> <i>Terrestrial Ecosystem Research Network and the University of Queensland and Maitec, Qld</i>	Electrical impacts of bushfires on transmission lines <b>Tony Gillespie</b> <i>Gillespie Power Consultancy, Qld</i>

	Initial findings on the Bushfire Convective Plume Experiment: Examining Pyroconvection with Portable Radar <b>Nicolas McCarthy (S)</b> <i>University of Queensland, Qld</i>	Playing with fire: The disparities with observed and model predictions of fuel loads <b>Dr Diana Virkki</b> <i>Ten Rivers, Qld</i>	The Tasmanian Bushfires of 2013 - An Environmental Response <b>Michael Emmett</b> <i>Tasnetworks, Tas</i>
<b>1250 - 1335</b>	<b>Lunch: Union Complex, Building 21C</b>		
<b>1335 - 1450</b>	<b>PLENARY SESSION:</b> Abel Smith Lecture Theatre, Building 23. Chair: Dr Simon Heemstra (Rural Fire Service, NSW). <b>Panel Discussion:</b> Intelligent Fires - how can fire research and knowledge better connect with drip torches?		
<b>1450 - 1550</b>	<b>THEME 8: Fire and Land Management</b> , <i>Prentice Bld (Bld 42) Room 216.</i> Chair: Michael Reif (Sunshine Coast Regional Council)	<b>THEME 9: Fire, Threatened Species and Conservation</b> , <i>Bld 23, Abel Smith Lecture Theatre.</i> Chair: Dr Geoff Lundie-Jenkins (Queensland Parks and Wildlife Service)	<b>THEME 10: Fires in the Past: Essential Knowledge for Management</b> , <i>Bld 63, Physiology Lecture Theatre, Rm 348.</i> Chair: Associate Professor Patrick Moss (University of Queensland)
	Reflections on the NSW Bush Fire Environmental Assessment Code since 2006: Continuing to meet the need <b>Dr Simon Heemstra and Jennie Cramp</b> <i>Rural Fire Service, NSW</i>	Fire management for conservation: Outcomes of AWC's fire programs across northern Australia <b>Dr John Kanowski</b> <i>Australian Wildlife Conservancy, Qld</i>	Late Quaternary fire regimes of Moon Point, Fraser Island <b>Philip Stewart (S) and Associate Professor Patrick Moss</b> <i>University of Queensland, Qld</i>
	National Burning Project <b>Deborah Sparkes and Greg Esnouf</b> <i>Australian Fire and Emergency Service Authorities Council, Vic</i>	How long is too long: The response of woody plants to inter-fire intervals in grassy forests of the Border Ranges, NSW <b>Dr Elizabeth Tasker and Dr Penny Watson</b> <i>Office of Environment and Heritage, NSW</i>	Satellite imagery interpretation of current and past fire history information in the Upper Maranoa area of southern inland Queensland <b>Peter Thompson and Rhonda Toms-Morgan</b> <i>Queensland Murray Darling Committee, Qld</i>
	Using prescribed burns to achieve biodiversity outcomes through weed management <b>Dr Kirsten Abley and Anthony Abley</b> <i>Department of Environment, Water and Natural resources, SA</i>	Planning, Implementing and evaluating fire management- Recurrent issues and responses in a range of environments <b>Murray Haseler</b> <i>Bush Heritage Trust, Qld</i>	The influence of time since last fire on the soil seedbank and woody understorey of temperate eucalypt forests <b>Helen Vickers (S), Dr Craig Nitschke, Dr Thomas Duff and Dr Sabine Kasel</b> <i>University of Melbourne, Vic</i>
<b>1550 - 1620</b>	<b>Afternoon Tea: Union Complex, Building 21C</b>		
<b>1620 - 1735</b>	<b>THEME 8 continued: Fire and Land Management</b> , <i>Prentice Bld (Bld 42) Room 216.</i> Chair: Michael Reif (Sunshine Coast Regional Council)	<b>THEME 9 continued: Fire, Threatened Species &amp; Conservation</b> , <i>Bld 23, Abel Smith Lecture Theatre.</i> Chair: Dr Geoff Lundie-Jenkins (Queensland Parks and Wildlife Service)	<b>THEME 10 continued: Fire in the Past: Essential Knowledge for Management</b> , <i>Bld 63, Physiology Lecture Theatre, Rm 348.</i> Chair: Associate Professor Patrick Moss (University of Queensland)

	Ecological ignitions: Suggestions on how to ignite ecologically beneficial fire in subtropical and tropical eucalypt forests <b>Dr Paul Williams</b> <i>Vegetation Management Science, Qld</i>	Managing fire to help prevent the extinction of the Coastal Emu: A successful collaboration between Hotspots and a more traditional NRM project <b>Mark Graham</b> <i>Nature Conservation Council of NSW, NSW</i>	A late Quaternary fire history of the Kimberley region, northwest Australia: new records from the Northern Kimberley Bioregion <b>Emily Field (S), Associate Professor Patrick Moss and Professor Hamish McGowan</b> <i>University of Queensland, Qld</i>
	Red Hot Tips: Building capability and capacity of private landholders to conduct planned burning <b>Leanne Sherriff and Justin Cashion</b> <i>Macquarie Franklin and Ground Proof Mapping, Tas</i>	Relative effects of fire on fauna in fragmented grazing landscapes <b>Dr Teresa Eyre</b> <i>Queensland Herbarium, Qld</i>	Fires in the past: An overview of late Quaternary burning patterns for eastern Australia <b>Associate Professor Patrick Moss</b> <i>University of Queensland, Qld</i>
	Fire behaviour in buffel grass dominated mine site rehabilitation in central Queensland, Australia <b>Dr Phill McKenna and Dr Peter Erskine</b> <i>University of Queensland, Qld</i>	Overcoming critical ecological thresholds in fire-excluded ecosystems: Restoration of an endangered heathland in rapid transition to forest <b>Andy Baker</b> <i>Southern Cross University, NSW</i>	A 150-year fire history of mulga dominated vegetation in semiarid Queensland, Australia <b>Dr Bradd Witt, Dr Jennifer Silcock and Dr Rod Fensham</b> <i>The University of Queensland and Queensland Herbarium, Qld</i>
	The effect of fire and rainfall in gross primary productivity in northern Australian savannas <b>Barbara Bernal (S), Dr Andrew Edwards and Professor Lindsay Hutley</b> <i>Charles Darwin University, NT</i>	Burning an endangered species: importance of understanding habitat dynamics for Northern Eastern Bristlebird conservation <b>Zoë Stone (S), Associate Professor Martine Maron and Dr Elizabeth Tasker</b> <i>The University of Queensland, Qld and the NSW Office of Environment and Heritage, NSW</i>	<b>Group Discussion</b> Fires in the Past: Essential Knowledge for Management
<b>1740 - 1755</b>	<b>CLOSING SESSION:</b> Abel Smith Lecture Theatre, Bld 23 Chairs: Dr Samantha Lloyd and Craig Welden (SEQ Fire and Biodiversity Consortium)		
<b>1800 - 1815</b>	<b>Bar open to purchase pre dinner drinks</b> <b>Bushfire 2016 Dinner: Union Complex, Building 21C</b>		

## Friday 30th September

<b>0620 - 1700</b>	<b>Field Trip 1: North Stradbroke Island</b>
<b>0800 - 1600</b>	<b>Field Trip 2: Sunshine Coast</b>

**Notes:** The program may still undergo minor changes. (S) = Student Presentation

## Field Trips

**NB:** Please note, you must have pre-booked in order to attend one of these field trips.

### Field Trip 1: North Stradbroke Island

North Stradbroke Island (NSI) is the second largest sand island in the world and is home to places of incredible conservation value, including sand dunes, wetlands, endangered heathlands and freshwater lakes. Fire has played a key role in shaping the environment, with the local landscape being dominated by fire adapted sclerophyll vegetation communities. The island also has a long history of human settlement, with the oldest Aboriginal archaeological site (~20,000 years old) in South East Queensland and one of the earliest European settlements in the Moreton Bay region (1827).

This factor, along with the occurrence of several lakes and wetlands that contain palaeoecological records extending beyond 40,000 years, makes NSI uniquely placed to investigate the relationship between anthropogenic and natural fire regimes, as well as how Indigenous knowledge can shape fire management. The field trip will visit some of the key sites, shedding some light on modern fire management techniques, the influence of fire regimes on the contemporary landscape and long records of vegetation and fire change.

**Date:** Friday, 30 September, 2016

**Time:** 0620 – 1700

**Departing:** UQ Lakes Bus Stop Platform C (refer to Map of University) at 06:30 SHARP

**Guided by:** Dr Jan Alden Hoven, NSI resident and biologist; Darren Burns, Quandamooka Yoolooburrabee Aboriginal Corporation; Dave Kington, Queensland Parks and Wildlife Service, Queensland Government; Dr Patrick Moss, Associate Professor, Climate Research Group, School of Geography, Planning and Environmental Management, University of Queensland; Dr Paul Williams, Vegetation Management Science, Consultant.

**Includes:** Return coach and ferry transport, morning tea, afternoon tea and expert guides. There will be an opportunity to purchase lunch on the island at a reasonable cost. You are also welcome to bring your own lunch if you have special food needs.

**What to Bring:** Be prepared for a day outdoors. Don't forget your hat, sunscreen, insect repellent, sunglasses, protective clothing, closed shoes, a water bottle and any medication you may require.

### Field Trip 2: Sunshine Coast

This field trip presents an ideal opportunity to learn about Traditional Owner fire projects, investigate the ecological impacts of frequent burning regimes, including an investigation into the responses of litter invertebrate fauna communities to fire-induced litter, managing bushfire risk in linear properties and we will also explore commercial forestry. The first stop on the Sunshine Coast field trip will be Wild Horse Mountain Lookout. Here we will take in panoramic views of the ocean, state forests and the Glasshouse Mountains, which is of deep spiritual importance for the Kabi Kabi/ Gubbi Gubbi and Jinibara people. Traditional Owners will speak about a new project to reintroduce cultural fires into the landscape.

After lunch at the Maroochy Bushland Botanical Gardens you will hear about managing fire risk and ensuring the conservation of twenty rare or endangered species. Finally, we will visit two sites from Australia's longest-running fire experiments, the sites cover a variety of ecosystems types including tall eucalypt and coastal heathlands.

**Date:** Friday, 30 September, 2016

**Time:** 0800 - 1600

**Departing:** UQ Lakes Bus Stop Platform C (refer to Map of University)

**Guided by:** Orpheus Butler, PhD Candidate, Griffith University; Susie Chapman, Healthy Waterway and Catchments; Kerry Jones Bunya Bunya Country Aboriginal Corp; Leigh Kleinschmidt HQ Plantations; Dr Tom Lewis Qld Dept of Agriculture and Fisheries, University of Sunshine Coast; Steve Martin, Powerlink Queensland; Michael Reif, Sunshine Coast Council.

**Includes:** Return coach transport, morning tea, lunch, afternoon tea and expert guides.

**What to Bring:** Be prepared for a day outdoors. Don't forget your hat, sunscreen, insect repellent, sunglasses, protective clothing, closed shoes, a water bottle and any medication you may require.

## Social Program

### Trade Display and Poster Session

On Wednesday evening we are holding a Trade Display and Poster Session in the Aung San Suu Kyi Conference Centre, Student Union Complex, Building 21C (the same space we are having registrations and meal breaks). This is a great opportunity to socialise and network with people in a more relaxed atmosphere, whilst interacting with the poster authors and visiting our trade display partners. Light refreshments will be on offer.

**Date:** Wednesday, 28 September 2016

**Time:** 1745

**Venue:** Union Complex, Building 21C

### Conference Dinner

On Thursday evening we're having an informal conference dinner to be held at the Aung San Suu Kyi Conference Centre, Student Union Complex, Building 21C (as per the Trade Display and Poster Session). The dinner ticket cost is \$55 (plus GST, Eventbrite fees and credit card fees) and the cost includes pre-dinner appetisers, gourmet pizza from the famous UQ Union Pizza Café (voted "Best Pizza in Brisbane" by ABC 612), one standard drink (beer, wine or soft drink), dessert and live music. Please note that in order to attend the dinner you need to have registered ahead of the conference for catering purposes. If you would like to attend and have not registered, please go to the registration desk where there may be some tickets available.

**Date:** Thursday, 29 September 2016

**Time:** 1800 bar open to purchase drinks for 1815 dinner

**Venue:** Union Complex, Building 21C



### Keynote Speakers

#### **A tale (mostly) of one city: Toward a comprehensive understanding of bushfire risks, present and future**

***Professor Ross Bradstock and Dr Owen Price, Centre for Environmental Risk Management of Bushfires, University of Wollongong, NSW***

Sydney is the largest city in the nation (circa. 5 million people in the greater region). The city and its accompanying Bioregion is endowed with spectacular natural assets, including rugged landscapes, picturesque waterways and diverse ecosystems. Fire is part of the furniture, posing both challenges, opportunities and a reminder to the human inhabitants of their interdependence with ecosystems. Exposure of people and property to recurrent fires is relatively high but both the perception and a quantification of the risk of losses is inadequately understood. A similar situation applies to biodiversity and the functioning of ecosystems on which residents directly and indirectly depend. Despite this situation, research progress into this problem has been rapid. Given the state of knowledge, five key conclusions emerge: 1) risks to people and property are low, in quantitative terms, but (paradoxically) are likely to be underestimated by residents; 2) ownership of risk and the responsibility for measures aimed at mitigation is shared; 3) a diversity of fire regimes is 'hard-wired' into many local landscapes which may buffer biota and ecosystems against changes; 4) manipulation of fire regimes to mitigate risks is possible but the scope is constrained by costs, benefits and socio-political will; 5) possibilities for change in the future may be surprising.

#### **Managing fire in the new millennium**

***Dr Neil Burrows, Science and Conservation Division, Department of Parks and Wildlife, WA***

The new millennium has brought with it a spate of devastating bushfires across southern Australia; in central and northern Australia, vast tracts of land continue to be blackened by harmful hot fires. Drought and extreme fire weather events attributable to climate change, and the regional buildup of flammable vegetation as a consequence of a reduction in area treated by prescribed burning, are key factors giving rise to mega-fires in southern Australia. The cessation of traditional Aboriginal burning practices across much of central and northern Australia has resulted in significantly altered fire regimes. Today, public land managers are required to manage fire for multiple outcomes including reducing the bushfire risk to human communities, conservation and environmental values. While the practice is contentious, prescribed burning is critical for managing flammable fuels to mitigate adverse impacts of bushfires on the things we value. Wise application of prescribed fire is also integral to maintaining biodiversity, ecosystem health and to reducing greenhouse gas emissions. Climate change, changing land use and land owner demographics, industrial legacies, population growth, declining resources, opponents to the practice, and onerous risk management and planning procedures have contributed to a decline in prescribed burning. While fire and land managers can do little about climate change, they can work with the broader community to reverse the declining trend in land treated with prescribed fire. This requires integration of scientific and traditional knowledge, practical experience, community engagement and support, and political and organisational commitment to adaptive management in a changing world.

## Speaker Abstracts

### Fire, landscape pattern and biodiversity

*Associate Professor Alan York, School of Ecosystem and Forest Sciences, University of Melbourne, Vic*

In fire-prone ecosystems, fire, an agent of disturbance, can influence landscape heterogeneity at a range of spatial scales. This heterogeneity varies not only over space, but with time, as successive disturbance events reshape landscape pattern. The range of post-disturbance states and their spatial configuration is expressed as a landscape 'mosaic'; the nature of which in both space and time is thought to have a substantial influence on biodiversity. Because different species have different resource requirements, heterogeneous areas should support a more diverse biota than homogeneous ones, leading to a positive relationship between environmental heterogeneity and species diversity. Heterogeneous, species-rich landscapes should be more resilient to disturbances such as fire.

In 2009, following the large and significant 2003 and 2006/7 bushfires, the Victorian Department of Sustainability and Environment, concerned that such extensive fires were reducing landscape heterogeneity, initiated a Landscape Mosaic Burning (LMB) program to increase the amount of planned fire in the landscape. It was anticipated that this 'mosaic burning' undertaken at a landscape scale would help reduce the size, severity and impact of large-scale fire events, and maintain healthy and resilient ecosystems. The LMB program was accompanied by a substantial investment in research with partner institutions. Projects investigated aspects of fire refuges in the Central Highlands, and fire mosaics in East Gippsland and the Otway Ranges.

Outputs from our LMB research program in the Otways have improved understanding of relationships between biodiversity and landscape heterogeneity, identified strengths and weaknesses of using post-fire growth stages as surrogates for fauna habitat and helped refine our understanding of how other aspects of the fire regime and landscape features influence animal populations. In this presentation I summarise our research, highlighting what we have learnt, knowledge uptake by fire managers, and where we are currently going to refine current and evolving strategies.

## Speaker Abstracts

### Theme 1 Fire and Risk

#### **Holistic bushfire management at a continental scale: Achieving consistency and improvements**

*Cuong Tran, Ten Rivers, Qld*

Bushfires are a synonymous aspect of the Australian bush. Over millennia, fires have exhibited an overwhelming influence on ecosystems, as well as the psyche of Australia's inhabitants. Bushfires also make no distinction of land-manager, land-use or boundaries. Nationally, nearly 10% of the Australian landscape is impacted annually by fire, most occurring across the northern tropical savannas. The remainder of Australia is not immune to bushfires, impacts of prolonged drought make for conditions often resulting in catastrophic events, highlighted by the 2009 Black Saturday Bushfires which resulted in the highest human toll for a natural disaster in Australia's history. Bushfires are a part of the landscape and it is essential that we learn to live with them. Working at the continental scale, Ten Rivers, assists with bushfire management for lands owned by the Commonwealth Department of Defence. These landscapes support live firing activities of significant scale, the nature of these activities increasing the bushfire threat. To manage these risks whilst continuing to support training and sustain ecological viability requires a fine balancing act. This talk outlines the key steps to achieve this at the continental scale, including: - Well-planned and executed fire management plan – adapted / updated annually – is the only course of action that can reduce the bushfire risk and maintain ecological integrity - Prompt and responsive implementation of the plans ultimately results in ensuring training capability and operability for Defence's needs - Integration of activities to promote long-term landscape change - Consistent approach to monitoring / auditing for continuous improvement.

#### **Wye River Learnings and Recovery**

*Justin Leonard, CSIRO, Vic*

The bushfire that impacted Wye River and Separation Creek on Christmas Day last year has provided many new insights into how the landscaping and terrain context of a township influence the way fire spreads and ignites houses. It has also highlighted the potential risks that certain landscape and terrain scenarios present for residents that are faced with having to defend their house during a bushfire. These learnings challenge some of the conventional assumptions that exist around house and landscape design and hopefully will encourage us to consider a broader range of issues that we may face in future bushfires.

## **SABRE Fire - A Stochastic Simulation-based Fire Spread Decision Support System**

***Ben Twomey, Queensland Fire and Emergency Services, Qld.***

In this presentation we introduce the Queensland Fire and Emergency Services (QFES) approach to leveraging simulation-based probabilistic prediction products for operational and strategic decision making. Simulation Analysis-based Risk Evaluation (SABRE) is a comprehensive framework and tools enabling all hazards predictive decision support. SABRE aims to permit open and easy definition and management of input and forecast data uncertainties for any suitable hazard simulation. It then employs Monte Carlo sampling techniques to generate many trials of a deterministic simulation (in the case of fire, Phoenix RapidFire is used) with inputs randomly drawn from definable probability densities.

It then translates the multiple outputs (alternative fire futures) into intuitive, interactive risk-based decision support tools while ensuring predictions and analysis products are generated consistently, robustly and within useful operational timelines. SABRE products are able to be securely accessed from outside the QFES network on any standard computer or smart device via a web browser by volunteers and other agencies as needed. It will contain predictive products tailored for operational decision makers managing response operations, through to strategic pre-deployment and planning decisions, thus providing support across all phases of disaster management

## **Managing ecological risks in prescribed burning**

***Wayne Kington and Adrian Pyrke, Australian Fire and Emergency Service Authorities Council, Vic***

The challenge for land managers today is to understand and apply the right kind of fire with the right techniques at the right times and places to deliver the various outcomes that prescribed burning can achieve. In an environment where the competing objectives for fire and land management are increasingly complex, underpinning our prescribed burning with the best possible ecological outcomes is an important part of fire management. Despite the large variation in fire regimes and the significant differences in extent and frequency of planned and unplanned fires in landscapes, particularly between northern and southern Australia, there are some key common principles that emerge.

Through the National Burning Project, AFAC has sought to engage with prescribed fire practitioners throughout Australia to draw out these common principles and derive a common operating framework for addressing risk to ecological values at all levels of prescribed burning management. This risk management framework for ecological risks associated with prescribed burning provides a way to consider the steps and processes that all land managers can take when seeking the best ecological outcomes. It offers a synthesis of concerns, approaches and activities that organisations across Australia engage in to manage ecological risks associated with prescribed burning. In this conference presentation we outline the key features of the risk management framework and highlight the principles that all prescribed fire managers can use to reduce risk to ecological values.

## Implementing a Risk Based Approach to Fire Management in Victoria

*Frazer Wilson, Department of Environment, Land, Water and Planning, Vic.*

The Victorian Government has adopted a strategic risk based approach to bushfire management known as Safer Together. This approach combines strong community partnerships with the latest science and information to more effectively reduce bushfire risk to human life, property and assets, and to maintain ecosystem resilience. The Department of Environment, Land, Water and Planning, which is responsible for the management of public forests and parks in Victoria has adopted this approach in catchments called bushfire risk landscapes. This presentation will investigate how this is happening within the East Central bushfire risk landscape. The East Central bushfire risk landscape contains approximately a third of Victoria's bushfire risk. Over three million people live in the East Central landscape, together with many rare and threatened plants and animals and significant community assets including most of Melbourne's water supply and nearly all of Victoria's energy supply.

Managing risk means managing risk to all these values and evaluating the results, and improving management practices. We use a metric known as Residual Risk to understand the risk of bushfire to life, property and other assets such as water supply catchments. Residual risk enables an understanding where fuel modification and community education can be targeted to protect these assets. Planned burning as the primary fuel management activity undertaken this will influence and potentially impact on flora and fauna species. Using a new biodiversity metric known as Geometric Mean Abundance we can now model the ideal and current ecological status of an area. Working with the Victorian Country Fire Authority, local governments, water authorities and communities we share our knowledge to ensure all agencies are working with the same information. East Central's Risk Based information is used by fire managers to improve their planning and ensures that fuel management is implemented in accordance with the risk based fuel management strategy.

## The application of economics in US wildfire management

*Dr Tyron Venn\*, David Calkin and Matt Thompson, University of the Sunshine Coast\*, Qld and the USDA Forest Service, Rocky Mountain Research Station, USA*

Characterizing the economic impacts of wildland fire is critical information for fire management decision making. We review the application of economic information (specifically the cost plus net value change (C+NVC) model) in US wildfire management. We consider key decision factors such as context, complexity, alternatives, consequences, and uncertainty. In particular we focus on management of the low-probability, high-consequence events that often account for the majority of costs and losses, and where C+NVC might be most limited. Two of the largest knowledge gaps relate to quantifying fire impacts to ecosystem services, and modelling relationships between fire management activities and avoided losses.

To conclude we offer recommendations for future research, including expanded use of the economics toolkit to better characterize the productivity and effectiveness of suppression actions, integration of ecosystem modelling with economic principles, and stronger adoption of risk and decision analysis within fire management decision making.

## **QFES Predictive Services Team: Planning, preparedness, response and recovery**

***Andrew Sturgess, Queensland Fire and Emergency Services, Qld.***

In this presentation we outline the problem that predictive services aims to address. Queensland Fire and Emergency Services (QFES) Predictive Services Unit (PSU) was formalised in September 2014. The Unit utilises trained specialists, the latest tools and technologies to support decision makers across the disaster management decision making cycle. This includes planning, preparedness, response and recovery.

The capability enables risk managers to more efficiently and effectively protect life, property, the environment and the economy from the devastating effects of bushfire. The requirement to build such a capability has been recognised by all Australian fire and emergency management agencies; however, there are challenges in both implementation and acceptance. A critical component for the capability has been building partnerships with land management agencies and interstate fire managers. Today more than ever before decisions need to be justifiable, repeatable and based on the best available evidence. Interstate fire and emergency management agencies have had intense third party scrutiny following catastrophic fire events. It is reasonable for our stakeholders to expect that QFES will have leveraged from these experiences and that we are prepared for events of this magnitude in the future.

An important focus of any post event analysis is mitigation strategies. Bushfire simulators, such as Phoenix RapidFire (Phoenix), have been used interstate to quantify fuel reduction effectiveness on mitigating the effects of bushfires. QFES initially deployed Phoenix in the response phase of operations where an ignition has been reported and rapid modelling can be used to assist with assessing fire behaviour to assist with suppression strategies and community warnings. The then Department of Sustainability and Environment in Victoria developed new ways to deploy Phoenix to support planned burning strategy analysis.

The State Fire Management Council in Tasmania built upon this work when they developed their approach to reducing State-wide relative risk. New South Wales Rural Fire Service also deploy Phoenix in the planning phase of operations and in 2016 QFES is aiming to build further upon this excellent work that our interstate colleagues have undertaken. The PSU is building landscape scale risk mapping to support hazard mitigation decision makers both internal and external to QFES. The aim is to translate the most up to date science, tools and technology to provide products that support community engagement, building resilience and enhancing the way the fire is managed in Queensland.

## Investigating issues of implementing a strategic tenure-blind prescribed burning program in South Australia

*Tim Groves, Department of Environment, Water and Natural Resources, SA*

Public land agencies within SA (Department of Environment, Water & Natural Resources, Forestry SA and SA Water) undertake a significant prescribed burning program across public land to reduce the impact of bushfire on the community and biodiversity. Limited strategic prescribed burning is undertaken on private land. In the high risk area of the Adelaide Hills, approximately two thirds of high fuel areas are privately owned. Much of this is adjacent to peri urban areas. Confining fuel reduction prescribed burning to public land is restricting the strategic effectiveness of community bushfire protection at a landscape scale. The SA Country Fire Service (CFS) is currently developing Bushfire Management Area Plan's across bushfire prone areas of the state.

These plans aim to assess bushfire risk to values across the landscape and determine bushfire mitigation strategies. In alignment with current best practice and national trends, a key mitigation strategy will be to manage fuels in high risk location across the landscape, irrespective of tenure. In 2016, DEWNR and CFS commenced a project with an aim to address the issues associated with how a strategic tenure-blind prescribed burn program could be delivered.

This project will explore and make recommendations on key issues, including:

- What legislative / legal impediments exist for delivering burns across various land tenures?
- What delivery models are appropriate for burns of various operational and environmental assessment complexities?
- What strategies are required to best facilitate landholders / CFS volunteer brigades in undertaking fuel reduction and ecological burning on private land?

The outcomes of this project are to be delivered to the State Bushfire Coordinating Committee prior to the start of the 2017/18 Fire Danger Season. This presentation will provide an update on work to date and future directions.

# Mechanical Fuel Load Reduction Trials

*Dr Fabiano Ximenes and John Samuel, Department of Primary Industry, NSW*

The National Bushfire Mitigation Programme (NBMP) is an Australian Government initiative that is providing \$15 million over three years to implement long term bushfire mitigation strategies and improved fuel reduction activities. Of the \$15 million funding package under the NBMP, \$1.5 million has been allocated to undertake mechanical fuel load reduction trials as a bushfire mitigation measure. The rationale for the mechanical fuel load reduction trials is to investigate an alternative form of fuel mitigation through mechanical intervention which offers certain advantages over conventional prescribed burning in certain strategic locations. Mechanical reduction of fuel load offers a number of significant additional advantages alongside conventional prescribed burning in many hazard situations, but is a relatively new concept in Australia despite being widely adopted in the United States and Canada (Deloitte Access Economics, 2014; Stephens, 2014). Its potential for application in Australia is significant, however it is yet to be rigorously trialled or costed.

The mechanical fuel load reduction trials will research whether there are operational and economic advantages in the mechanical removal of fuels either in addition to, or as an alternative to, prescribed burning. These advantages relate to:

- community concerns over smoke and air quality;
- the narrow window of weather days for undertaking fuel reduction burning;
- risk management, in terms of managing fuel loads in areas that are in close proximity to population centres or other important assets including conservation areas and infrastructure;
- addressing tree overstocking and upper strata (i.e. ladder) fuels; and
- utilising a potential market (i.e. return) from the sale of biomass fuels that can help offset treatment costs.



## Factors driving flammability in the mountainous forests of Victoria

*Dr Jane Cawson, Dr Thomas Duff, Dr Trent Penman and Associate Professor Kevin Tolhurst, University of Melbourne, Vic*

The mountainous forests of Victoria exhibit a mosaic of dry and wet Eucalyptus forests with contrasting susceptibilities to fire. The drier forests on the ridges and equatorial-facing slopes are more available to burn while the wetter forests in the gullies and the polar-facing slopes are usually unable to support fire. This flammability gradient enables managers to use the wetter forest as a passive barrier during prescribed burning, protecting gullies in water supply catchments, timber values and habitat.

However, during certain dry climatic conditions, the wet forests transition to a state that allows fire, meaning the landscape is no longer fragmented from a flammability perspective and fires can become large and difficult to suppress. Fuel moisture is an important factor driving flammability in these forests, but its spatial variability in complex terrain and importance relative to other factors (e.g. species composition and fuel structure) is poorly understood. Here, we present preliminary results from a project that is collaborating with land managers to analyse prescribed burns in mountainous forest. At each burn we measure pre-burn vegetation properties, weather and fuel moisture, fire behaviour and post-burn outcomes. We've found that flammability is highly sensitive to understorey vegetation properties – particularly fuel moisture, species composition, the proportion of live vegetation and fuel continuity.

The relative importance of these factors varies depending on weather, the nature of the ignition source and topographic position. Understanding the factors driving these 'flammability states' in the wetter forest will be valuable for predicting burn outcomes and modelling risk at a landscape level.

## Law for Resilience to Bushfire in peri-urban Australia: A Tasmanian Case Study

*Joseph Wenta (S), Professor Jan McDonald and Dr Jeffrey McGee, University of Tasmania, Tas*

Climate change is increasing the frequency and intensity of extreme weather events, including bushfire. Bushfire danger in Tasmania, for example, is projected to double by 2100 in a high emissions climate change future (ACE CRC, 2015). Similar increases in bushfire risk are predicted across south-eastern Australia; a two- to four-fold increase by 2050 in the number of extreme fire danger days is projected in a high emissions future (Lucas et al, 2007; IPCC AR5 WGII, 2014). The colocation of human and ecological communities in peri-urban areas makes them particularly vulnerable to bushfire risk. Bushfires in the peri-urban fringe, such as the 1967 Black Tuesday bushfires in Tasmania, the 2003 Canberra bushfires, and the 2009 Black Saturday bushfires in Victoria, have major impacts on human life and health, property and ecological systems.

In a future of increasing bushfire risk, combined with larger population in peri-urban areas, it is both important and urgent that legal and policy frameworks governing bushfire management are designed and implemented to promote resilience.

While the concept of resilience has gained increasing purchase as a policy objective in emergency management, little attention has been paid to the influence of law and governance arrangements on resilience to bushfire risk. We investigate the influence of legal and governance frameworks on the resilience of peri-urban communities to bushfire risk through a case study situated in the Mount Nelson/Tolmans Hill area on Hobart's peri-urban fringe. In particular, there is a need for reform in three key areas: clearer allocation of responsibility for bushfire risk; developing legal frameworks that embrace adaptive management; and expanding community participation in governance processes.

Such reforms are likely to be undertaken incrementally, rather than in a single overhaul of current arrangements, but their implementation is critical in addressing the exposure of peri-urban communities to bushfire risk.

## Navigating asset protection and biodiversity conservation objectives associated with fire management in Dry Sclerophyll Forest, City of Gold Coast

*Brooke Williams (S), Associate Professor Kerrie Wilson, Dr Luke Shoo and Dr Hawthorne Beyer, University of Queensland, Qld*

Wildfire in Australia causes significant damage to infrastructure and communities, contributing approximately 10% of the cost of all natural disasters in Australia. The frequency of wildfire in Australia is increasing, and is attributed largely to climate change. Drier and warmer weather results in higher than usual wildfire potential, as well as fire seasons occurring earlier in the year and over a longer period. This reinforces the need for wildfire mitigation practices to be implemented by land managers in areas where urbanisation encroaches into fire prone ecosystems. Prescribed burning is currently the most cost-effective way to achieve fuel reduction in large landscapes. Fire is also an integral aspect of many Australian ecosystems, and may be considered a “keystone ecological process” for fire-dependent communities. It is important that ecosystems are maintained within appropriate fire regimes.

Prescribed burning for asset protection often takes precedence over burning for biodiversity conservation objectives. This can lead to too frequent burning in key asset protection zones, and exclusion of fire elsewhere in fire-dependant ecosystems. Navigating these two often-conflicting objectives remains a challenge for managers who are also constrained by financial and time limitations. In an uncertain future, novel methodologies for improving fire management practices that consider potentially competing objectives are needed. The goal of this study is to identify spatial fire management solutions that consider both asset protection and biodiversity conservation objectives while remaining within annual budget constraints. Here I develop a novel optimisation process to assist decision-makers to navigate these joint management objectives using the Dry Sclerophyll Forest ecosystem of the City of Gold Coast as a case study.

## Theme 2

# Cultural Burning and Traditional Custodian Fire Projects

### Cultural Pathways of Fire

***Oliver Costello\*, Co-founder of the Firesticks Initiative and Visiting Fellow, University of Technology Sydney, NSW***

Cultural fire is a story of place and has many uses, characteristics and impacts. We explore what we can learn from cultural pathways of fire. Fire's function in the landscape is as diverse as the country and people interconnected with it. Fire is known by many terms in many languages; Firesticks uses the term cultural fire to describe the myriad of ways that fire occurs in cultural practice and belief.

Cultural fire has spirit and authority and must be respected. The cultural values and practices that manifest as cultural fire are underpinned by a fundamental intent of cultural custodians to care for community and country. The intent can be understood through the interconnected relationships and kinship between all elements and beings. Cultural Fire management aims to protect and enhance plants and animals, stories and places. These important ways of looking after country and people - the campfire for warmth, light, cooking and sharing stories, smoking ceremonies for welcoming and cleansing, burning for maintenance of camping areas, clearing pathways, and tending and protecting assets and resources. Cultural Fire can create a pathway for recognition and to rebuild cultural frameworks that exist in the landscape, where clans, families and larger language groups act together to look after country. Fire was traditionally a more complex and dynamic approach where everybody had restrictions, rights and responsibilities.

Not just burning, but really acknowledging kinship of country and assuming responsibility for all actions. Today cultural fire is helping people to reinvigorate governance and create a sense of identity and responsibility. Aboriginal communities, particularly in the south-east, have limited access to country and no longer have as much opportunity to burn country, which has affected our identity and culture.

Many communities don't feel like they have enough knowledge, but there's a lot of knowledge in connection and practice. Community knowledge holders know the important places, special sites for plants and animals, pathways, and old camp and ceremony sites. Sometimes the old people will say things like 'this was emu country' and you look around and think 'where's the emu country?' It's just all covered in dense bush - no food or space for Emu, but what they are saying is - it was not always this way. Unpacking history often reveals fire stories and knowledge. Firesticks provides Indigenous leadership, advocacy and action to protect, conserve and enhance cultural and natural values of people and country through cultural fire and land management practices. Fire is essential to Aboriginal cultural practice.

## Fire Planning for the Katiti Petermann IPA : Family Fire Country

*Jane Blackwood, Tracey Guest, Selina Kulitja, Bernard Bell and Raymond James, Central Lands Council, NT*

In October 2015, the Katiti and Petermann Aboriginal Land Trusts were declared an Indigenous Protected Area. The Katiti Petermann IPA is managed under an agreement with the Federal Government called *Ngura Nganampa Kunpu Kanyinma* - Keep on Looking After Country Strongly. Governance of the IPA is the responsibility of Anangu (Traditional Owners) who have elected a 16 member management committee representing the 4 sub regions . The IPA is over 5,000,000ha, surrounds the iconic Uluru Kata Tjuta National Park, contains Yulara -the resort town associated with the Rock and has over 2000 Traditional Owner family members.

How do you manage fire in such a remote setting area with few access tracks and Anangu (Traditional Owners) scattered across 3 states? The current plan of management calls for the update and review of the previous fire strategy, now incorporating both ALT areas under the new leadership of the IPA Management Committee. To begin the process a round of consultations was undertaken with over 250 Traditional owners in 10 communities, followed by interviews with all neighbouring property owners and partners and a Tri-state meeting with Southern and Western Australian neighbours.

During the consultation process a huge wealth of information was mapped from conversations directed at describing key values. Anangu were precise about where and who could burn country, this resulted in the IPA being demarcated into 34 family fire countries. Anangu also listed family members responsible for future fire management. During the consultation families nominated areas to be burnt in their family fire countries over the next 5 years. Clearly families and the education of young people is central to the practice of fire management, and although fire is the tool, cultural education is the driver.

Criteria based on key values were developed for prioritising which areas to burn each year. Each year the management committee engages in a fire planning cycle which prioritises four Waru (fire) trips and burning for the Ranger work program. This work is broadly consulted with neighbours for where collaborative burning work can occur. During the implementation of the proposed burn program, families collect and add information to digital country maps which is then updated so that the maps digital and hard copy become a primary tool in educating young people and Rangers.

## Cultural fire landscapes on North Stradbroke Island (Minjerribah)

*Dave Kington\*, Darren Burns^ and Dr Paul Williams, Queensland Parks and Wildlife Service\*, Quandamooka Yoolooburrabee Aboriginal Corporation^ and Vegetation Management Science, Qld*

North Stradbroke Island (Minjerribah) is one of a string of barrier islands off the Southeast Queensland coast which includes Moreton Island, South Stradbroke Island, Bribie Island, and Fraser Island. These are sand islands with discreet and distinct ecological communities with a history of forestry or sand mining.

Traditional owner connection to these islands has led the way to native title claims and determinations. In 2011, the Quandamooka Peoples native title rights and interests were recognised over areas on and surrounding North Stradbroke Island. Approximately 50% of the island is managed as an indigenous joint management area by the Quandamooka Yoolooburrabee Aboriginal Corporation and Queensland Parks and Wildlife Service.

Archaeological investigations indicate more than 20,000 years of Aboriginal occupation on North Stradbroke Island. The existence in the landscape of forests with very old, large cypress pines and eucalypts, and an open grassy structure, indicates an extremely long term cultural use of low intensity fire. Ecological surveys indicate a recent pattern of occasional high intensity fires with long fire intervals, which has damaged or killed many old cypress pines and eucalypts, caused widespread loss of native Kangaroo grass cover, and increased shrub density.

The rapid and ongoing loss of these vegetation communities is of critical concern to the traditional owners and the Queensland Parks and Wildlife Service when developing an appropriate fire strategy that considers the overall risks to life and property and habitat and wildlife, while also maintaining the traditional cultural landscape. This traditional cultural landscape is considered a relic of the past and of significant cultural value, and further investigation of Aboriginal fire management practices and possibly a return to these practices may be appropriate for highly significant areas.

## Winba = Fire: Developing a fire and seasons calendar for Wattleridge IPA

**Michelle McKemey and Lesley Patterson, University of New England and Banbai Employment Development Aboriginal Corporation, NSW**

The Banbai rangers of Wattleridge Indigenous Protected Area are undergoing a revival of utilising fire as a management tool to regenerate native vegetation, protect ecological and cultural values and reduce the threat of wildfire on their country with support from the Nature Conservation Council (NCC) Firesticks Project.

Through participatory action research, a PhD researcher and the Banbai rangers are working collaboratively to better understand the changes that occur when low intensity cultural burns are reintroduced to the IPA. Together we have developed two-way ecological monitoring of the effect of fire on the threatened black grevillea (*Grevillea scortechinii subsp. sarmentosa*) and culturally significant echidna (*Tachyglossus aculeatus*).

Over the last four years the Firesticks Project has been conducting seasonal pre and post-fire scientific monitoring. Utilising this data as well as information gained through direct observations and literature reviews, we are developing WINBA = FIRE, a fire and seasons calendar for Wattleridge IPA.

The calendar uses Indigenous and scientific knowledge to enable land managers to:

- Determine appropriate timings and types of burn that may be applied in relation to vegetation type and fire history
- Identify and interpret biocultural indicators of ecosystem health and fire responses
- Use the information as an educational resource for fire practitioners, community and local schools.

We hope that through the production of WINBA = FIRE, we will demonstrate how scientists and Indigenous communities successfully work together to manage fire.

## Minyumai Rangers use fire and burning to convert a long-grazed and weed dominated clearing back into coastal forested wetland vegetation

*Daniel Gomes, Marcus Ferguson, Justin Gomes, Daniel Wilson, Belinda Gomes, Emma Wilson, Kesha Wilson and Lilly Wilson, Minyumai Land Holding Aboriginal Corporation, NSW and Ngunya Jargoon Indigenous Protected Area, Jali Local Aboriginal Land Council, NSW*

Herbiciding followed by burning (and herbicide alone) has been used to achieve regeneration of native groundcovers and control pasture weeds on a 16 ha forested wetland at Minyumai Indigenous Protected Area (IPA) near Evans Head, NSW. The area was cleared for grazing in the 1960s and then became infested with the pasture grass *Setaria* (*Setaria sphacelata*). The Minyumai Rangers are now attempting to convert the site back to its original native vegetation with funding assistance from the Commonwealth's IPA program, NSW Nature Conservation Council's Firesticks program and the NSW Environmental Trust.

Results to date show that extensive regeneration of 23 native species (including 3 trees in low densities) and only 8 weed species has occurred. The pasture weed *Setaria* also regenerates prolifically but is progressively treated by spot-spraying. Challenges have been meeting the weed follow up requirement during the high-growth Christmas period and damage from feral cattle, pigs and kangaroos who are attracted to the green pick in the regeneration area. The Rangers are strongly engaged in the project and have developed strong competencies in burning, weeding, native plant recognition and project coordination. Sites-native tree seed has been collected and grown in the Ngulingah Land Council's nursery for planting after the control of the feral cattle.



## Fusing 'Tech' and 'TEK': Queensland's Cape, fire and forging partnerships

*Janie White and Les Harrigan, Queensland Parks and Wildlife Service and Rinyirru Land Trust Corporation*

With a fire history program stretching back at least 40,000 years, Cape York protected area fire management faces new challenges. In a fire landscape where savannah already burns too intensely and too late in the season, or in a few situations where tropical coastal sclerophyll forests no longer burn frequently enough, new issues are emerging which further complicate fire management.

These issues arise from the multitude of land uses, natural fire sources and disturbance by cyclones and tracks and roads which shape the Cape. Park managers in this region must now also give consideration to protecting our adjoining carbon abatement properties from intense fire escaping off estate; and lowering a wildfire-stimulated increase in predation on native fauna by feral cats. This is overlain with competing industries and ecotourism, and fewer people to manage the conservation of vast tracts of country, remote recreation experiences and cultural and social community purposes. These influences combined create an imperative to improve fire management well ahead of when these issues worsen.

Fusing "Tech" (new technology) with "TEK" (traditional ecological knowledge) provides a future path for a more resilient landscape, communities and people, with positive steps already progressed through joint fire management of CYPAL national parks. Shared responsibility, purpose and respect between traditional owners and the Queensland Parks and Wildlife Service is improving both early season mosaic burning outcomes and protection of cultural values and practices. It should also serve to mitigate against the threat of a downward spiral to emergency or crisis management in this poorly conserved landscape.

Presentation includes video production.

## Fire management on the Western Cape: Tradition, science and building economic opportunity

**Gavin Kendall, Eddie Kendall and Peter Barker\*, Pormpuraaw Aboriginal Shire Council and Queensland Indigenous Land and Sea Ranger Program\*, Qld**

Queensland now has over 200 community-based Indigenous Land and Sea Rangers who care for land and sea country, with funding provided by the Queensland and Australian Governments. Indigenous rangers implement a wide range of activities including weed and feral animal control, erosion control and rehabilitation, fencing of wetlands, cultural heritage management, community education and visitor management and fire management.

Pormpuraaw Aboriginal Shire Council with Pormpuraaw Rangers undertake annual early season prescribed burning of over 467,000 hectares of Pormpuraaw Deed of Grant in Trust land. This work is registered as a Carbon Abatement project with the Commonwealth government's Clean Energy Regulator through their Emissions Reduction Fund.

This project earns income that covers the costs of fire management and supports local traditional owner aspirations on country. The project uses local Indigenous knowledge coupled with the latest scientific advice to enhance the biodiversity values and reducing carbon emissions. The project has shifted the seasonality of the burning from the late dry season to the early dry season to ensure fire intensity is minimised, and to reduce the area that is burnt and any potential damage. Pormpuraaw Rangers use this Carbon Abatement money to diversify their funding base, which increases the autonomy of the rangers and allows them to undertake further work to ensure their environment remains pristine for future generations.

## People, fire and landscape in the Bunya Mountains

*Mick Smith, Bunya Murri Rangers, Qld*

The Bunya Mountains in S E Queensland were the site for large gathering of Aboriginal groups coinciding with bumper crops of nutritious Bunya nuts. Aboriginal people used strategic fire management in the Mountains and surrounds to facilitate access to the Bunya gatherings and to create habitat mosaics for hunting and gathering. Since the removal of Aboriginal people from the region from the 1870's, the absence of fire has led to a decline in the extent and health of the eucalyptus woodland and the unique bunya grasslands. Between 1996 and 2006 grassland decreased by 14%. Grasslands burnt once or more between 1996 and 2006 areas declined by 1%.

The Bunya Murri Ranger Working on Country program employs four Indigenous Rangers and a Coordinator. Cultural and management support is provided by the Bunya Peoples Aboriginal Corporation with BMRG providing contract management and administration. Since 2010, holistic ranger training has developed practical land management skills, strong cultural competency, and an experienced and accredited Indigenous Ranger fire team.

Several methods have been trialled to better understand fire management and ecosystem health in the woodlands and grasslands. An integrated approach to burning has evolved, acknowledging western science, utilising modern fire control equipment, incorporating traditional ecological knowledge and compliant with the usual bureaucratic framework. Cool burns have recently commenced on Russell Park using traditional skills to read country and to develop a mosaic pattern of burning to enhance biodiversity and to re-establish woody pathways and the grasslands. Through a partnership with the Queensland University of Technology (QUT), a monitoring and evaluation process is being developed to gauge the effectiveness of traditional burning practice in retaining the cultural and environmental values of the Bunya Mountains region.

## Cultural fire management on the Sunshine Coast for the first time since traditional times

**Kerry Jones\* and Susie Chapman, Bunya Bunya Country Aboriginal Corporation\* and Healthy Waterways and Catchments, Qld**

In a first for the Sunshine Coast, an enthusiastic collaboration of many partners has made it possible for local Traditional Owners to be trained in cultural fire management with a controlled burn following the traditional approach at Stockland's Aura development on Bells Creek south of Caloundra. With training from cultural fire experts Victor Steffensen and Oliver Costello, members of Kabi First Nation and Bunya Bunya Country Aboriginal Corporation undertook a cultural burn backed by five Rural Fire Brigades, Queensland Fire and Emergency Services, SEQ Fire and Biodiversity Consortium, Healthy Waterways and Catchments and landholder Stockland. Following a long history of grazing and pine plantation, the coastal ecosystem of the future Aura Environmental Protection Zone was regenerating with an overabundance of melaleuca and casuarina.

A restoration report written by Dr Rob Lamont identified the need to introduce frequent fire to the ecosystem to promote biodiversity, and to involve Traditional Owners in a cool mosaic burning process. After one day of training on country, a burn on 12 hectares of low-lying land known as "little Italy" between North and South Bells Creeks was conducted in June 2016. This followed heavy rain in the area the week before with seasonally temperatures above average. Ignition points were chosen by listening to the landscape in the old ways.

The first half of the burn was slow and patchy as hoped, and the second half of the burn was hotter than expected due to a number of factors. A review with all partners has reaped the learnings from the controlled burn to ensure that future burns are conducted with improved levels of communication and a deeper understanding of ignition methods. Filmmaker Victor Steffensen is producing a training film of the two days that will be available to Traditional Owners, RFBs and QFES staff to use.

## Preliminary results from monitoring the responses of vertebrate groups to applying contemporary indigenous burning practices in northern NSW IPAs

**David Milledge, Landmark Ecological Services, NSW**

For the past four years the Firesticks fauna monitoring project has been assessing the responses of three vertebrate groups to applying contemporary indigenous burning practices in four Indigenous Protected Areas in northern NSW. Contemporary burning in the IPAs involves the application of cool burns in a mosaic pattern in an attempt to mimic past indigenous burning practices that are considered to have been beneficial to biodiversity conservation. A standard survey methodology has been applied in four 2ha plots in each IPA, sampling a range of vegetation communities characteristic of the IPA.

In the first two years, surveying focused on establishing a pre-burn baseline against which to monitor post-burning responses. To date, nine of the total 16 plots have been burnt, two by unplanned hot fires before two years of baseline data could be obtained, and the remainder by controlled cooler burns. Responses of the target groups and their component species post-burning has varied, although most plots are in the very early stages of regeneration. However, the two plots burnt by unplanned hot fires, the earliest burnt, have provided the most interesting results to date. Numbers of some insectivorous bird species remained stable and then decreased whereas others decreased or disappeared before re-establishing. In one of these plots, seed-eating bird species increased and in the other one small mammal species increased and then decreased, one species decreased and then increased, one species disappeared before re-establishing and another species not previously recorded colonised the plot after fire. These and other responses are briefly discussed.

## Ornithogenic fire – Birds as propagators of fire in the Australian savanna

**Bob Gosford\* and Associate Professor Mark Bonta, Ethnoornithology Research Group\* and Penn State University, USA**

Birds have long been regarded as key taxa for the study of the impact of fire in the Australian savannah woodlands. Most studies have concentrated on the effect of fire upon bird populations and their habitats. Fire in Australian savanna woodlands – and the rest of the Australian continent – has two commonly accepted initiation sources, anthropogenic and lightning. Here we examine the possibility that one or both of two raptors, the Brown Falcon (*Falco berigora*) and the Black Kite (*Milvus migrans*), are a third factor in the propagation of fire in Australian savanna woodlands.

## Theme 3

# Community Engagement: Building Partnerships and Facilitating Change

## Connecting Community and Koala using Phoenix Rapid Fire

*Phillip Patterson, Rural Fire Service, NSW*

A Fire Management Plan has been developed through a cooperative planning process to address the risks posed by fire to a threatened koala population, located at Tanja (Biamanga) - on the Far South Coast of NSW. The Fire Management Plan was achieved with the cooperation of the NSW Office of Environment and Heritage, NSW National Parks and Wildlife Service, NSW Rural Fire Service, NSW Forest Corporation, the community of Bermagui/Tanja, the traditional owners of Biamang/Gulaga National Parks, University of Melbourne and University of Canberra. The plan supports other bush fire management strategies for the area including the Bega Valley Bushfire Risk Management Plan.

Koala activity surveys to determine the types and numbers of preferred koala habitat tree species were undertaken during the period 2007-9 and 2012-15, using a Regularised Grid-based Spot Assessment Technique. These surveys provided baseline data for ongoing monitoring programs to assist with operational decision making. Data has been linked to a statistical analysis package developed by the Institute of Applied Ecology, University of Canberra (ikoala), which generates reports from selected areas. The report includes distribution and abundance maps, lists preferred local tree species and tree size class preferences. The Bega Valley Bushfire Risk Management Plan delineates Strategic Fire Advantage Zones (SFAZ) where burning is carried out as a fuel reduction method. In the study area some of these zones overlap with areas of koala activity. Subsequent to the Risk Plan, the Biamanga National Park Board requested that a fire management strategy be developed to exclude hazard reduction burning from these areas. The Board also sought to create low fuel buffers adjacent to the areas of koala activity.

An important question that was addressed was whether fire management could be implemented and improved so as to offer greater protection to both koala and human assets. The University of Melbourne was engaged to assess 12 possible options for hazard reduction burning. The project made use of a computer based fire simulator (Phoenix Rapid Fire) to predict where hot and intense wildfires were likely to cause most damage to both property and koalas, and to compare and assess the relative benefits of each option.

The results were used to determine the best options for the Fire Management Plan and as a vehicle to consult with communities about the Plan. The Hotspots Project was also utilised as a means to enhance the communities understanding of the Fire Management Planning process for the koala population and fire in landscapes generally. The Project was instrumental in enlisting the community to be actively involved in the implementation of the overall Management Plan.

## Landholders linking through Landcare for landscape fire planning in the Queensland Murray Darling Basin for carbon, production and biodiversity

**Rhonda Toms-Morgan, Col Paton, Peter Thompson, Lynda Hardwick, Roxane Blakley and Donna Hurley, Queensland Murray Darling Committee and EcoRich Grazing, Qld**

Federal investment for carbon abatement through enhanced biodiverse carbon stores has proven to be a catalyst to mobilise primary producers, public and private sector participation in fire planning in the Queensland Murray-Darling Basin. A bottom up approach, facilitated through Landcare and Natural Resource Management organisations in Southern Inland Queensland has seen the rekindling and forging of new partnerships under a common purpose of supporting the use of fire as a safe management tool for biodiversity, carbon and production outcomes. "Landscape Fire Planning in Poplar Box Grassy Woodlands in the QMDB" project funded by the Australian Government is a 5 year project partnership with multiple landholder, fire, environmental, government and research agencies in the Maranoa.

Coming into its fourth year, the project, through demonstration sites and information sharing field days with land managers, CSG industry, researchers, local and state government agencies is engaging and supporting land managers to develop property and landscape fire plans that are reflective of land type management requirements across an area of over 300,000ha. It's also encouraging land managers to undertake monitoring and recovery planning for fire where possible as a part of their local primary producer fire brigade and Landcare groups.

The process being employed actively assists landholders make more informed decisions about their current use of fire, supporting their local knowledge with existing regionally relevant research. Long term partnerships are being forged and fostered across organisations and boundary fences. Trust is being developed between individuals and agencies, thus building networks spanning organisational and generational divides in the region contributing to resilience in landscape and people who make it their home.

## Capacity Building in the Surat Basin

**Murray Abel, Powerlink, Qld**

Powerlink had an extensive construction program in the Surat Basin region, completed in 2016. Fire-fighting was raised by landholders in the region as an issue of concern. Powerlink engaged with the rural fire brigade services in the region to define the needs of the community. Training programs provided a focal point for rural fire brigades to discuss competencies, local issues, resource requires and fire-fighting. Some slip-on units were purchased to add physical capacity for the brigades. The combined investments have been well received by the community and has provided lasting capacity building for the region to fight fires safely and effectively. Training incorporated high voltage electrical safety issues to ensure safe fire-fighting practices were adopted near transmission assets

## CFA Fire-Scape: Social factors in Community Fire Management

*Mike McStephen, Wellington Shire Council, Vic*

The social factors involved in establishing and maintaining Fire-Scape (a Country Fire Authority, Victoria (CFA) community fire ecology program) were observed during a series of 5 pilot sites. The communities involved had different motivations and social characteristics that led to varied levels of engagement and on-going commitment. The Fire-Scape project ran for two years from 2013 to 2014 which allowed sufficient time to make observations about factors enabling the program to become self-sustaining.

Community based groups are necessary for private land fire management and understanding how groups can sustain themselves is essential to its success. While the materials and workshops delivered in these pilot areas were the same, groups took up the Fire-Scape program to different degrees. This ranged from a group which took ownership of the delivery of the program and continued beyond the end of the project, to a group that lost momentum before the end of the pilot project.

The two key factors driving the initial interest in the project were the perception of fire risk and interest in fire ecology. The social factors that enabled the groups to remain engaged in the project were more varied and complex. These included:

- Skills – Burn planning, execution and fire ecology skills and knowledge
- Cohesiveness – Shared aims and a commitment to the group beyond the scope of the project
- Motivation – Extent of perceived risk or need for the project
- External support – The programme is a sufficiently high priority for the partner agencies to continue support
- Confidence – Confidence of the group (or key members) to take on ownership of the process after the formal programme has finished
- Capacity – The work capacity to sustain the effort

Identifying missing factors may enable project managers tailor support for communities to make them self-sustaining.



## Can citizens accurately report on fuel hazard?

*Dr Ernst Kemmerer and Mark Wisniewski, Cradle Coast NRM, Tas*

The National Bushfire Mitigation Programme is a targeted initiative to reduce the impact of bushfires and build a more disaster resilient Australia. The programme is designed to better equip communities to be able to prevent and, if needed, withstand the effects of bushfires. Cradle Coast NRM was awarded funding to complete a Citizen Science App to increase community involvement in reporting fuel hazards. Successful Citizen Science projects generally add value to science as well as provide two-way learning opportunities for people. The aim of this project was to find a method for assessing fuel hazard which had an element of 'fun' that could be embraced by citizens, and that was supported by scientific rigor.

An innovative sampling method was deployed to capture fuel hazard across all forest strata with ten randomly sampled horizontal throws of an 'Aerobie Sprint' frisbie (ASF). The ASF was used to measure distance thrown, height landed and fuel dryness. A variety of forest structure types from grasslands through to rainforest were sampled across 85 sites in northern Tasmania.

The method was shown to predict fuel hazard class to within one hazard category in 89% of cases across 44 sites used for model building, and 86% ( $n=41$ ) of study sites for model validation. When tested with student participants the ASF method was found to be accurate to within one hazard category 91% of the time ( $n=172$  students). Participants from the school study also reported high user acceptance with 75% of students preferring this method over subjective methods which were less 'fun' and less reliable for predicting fuel hazard. Community acceptance testing indicated mixed response from fire and land management agencies, while community involvement was enthusiastic for both the method and opportunities for two-way learning.

## **Building Partnerships and Facilitating Change for Improved Fire Management: The SEQ Fire and Biodiversity Consortium Model**

*Craig Welden, SEQ Fire and Biodiversity Consortium, Qld*

Dangerous bushfire weather is predicted to worsen with climate change, placing private landowners and public land managers under increasing pressure to improve management. The key to better managing this growing threat is effective partnerships with private landowners, who manage the vast majority of bushland in Australia. But, as scientists and land managers we need to get much better at building trust and initiating partnerships that empower landowners and allow for improved, sustainable management of fire in the Australian landscape. The South East Queensland Fire and Biodiversity Consortium (SEQFBC) was established in 1998 and aims to translate science into practice for improved fire management, fire ecology and biodiversity conservation in SEQ through education, engagement, applied research and representation.

The SEQFBC is hosted by Healthy Waterways and Catchments (formerly SEQ Catchments and the regional NRM body for SEQ), is supported by a further 18 organisations (local government, state government and utility) and is non-government. This sponsorship model supports 19 long-term partnerships and has resulted in numerous other partnerships and networks supporting government land managers, private landowners, utility land managers, Traditional Owners, students and researchers.

The SEQFBC provides a range of very popular services and products for its supporting organisations (and their respective land holders), including one-day forums (mini-conference), weekly e news service, summaries of research papers, Research Student Scholarship Program and one day private property Fire Management Planning Workshops.

Since 2010, SEQFBC have delivered ten forums to over 1000 attendees, 55 workshops to approximately 1370 participants in eleven local government areas and devolved \$10,000 in funds to four research students. This presentation will provide an overview of the SEQFBC Model and use specific examples to demonstrate how SEQFBC engages with stakeholders to share knowledge, build partnerships and support research, to better integrate science, conservation and fire management practices.

## Theme 4 Fire Ecology

### Evidence for bark thickness as a fire resistance trait from desert to savanna in fire-prone inland Australia

**Professor Mike Lawes and Dr Catherine Nano, Charles Darwin University and the Department of Land Resource Management, NT**

Although bark thickness and fire-activity are correlated in many ecosystems worldwide, substantial data-gaps remain, especially for dryland biomes, preventing generalisation of this relationship at the global scale. We examined bark thickness trends in trees and shrubs across a large-scale fire-rainfall gradient from desert to dry savanna in northern Australia. Bark thickness increased with local fire activity but was unrelated to mean annual rainfall or the mean normalised difference vegetation index (surrogates of resource-productivity). In high-fire regions, thin-barked trees were restricted to localised low-fire patches. Thicker bark was associated with sites characterised by flammable *Triodia* hummock grassland (spinifex). Within this flora, bark thickness reflected a trade-off in trait allocation to fire resistance versus fire resilience. For trees, thicker bark (fire resistance) was strongly associated with epicormic resprouters. In contrast, fire-resilient species that were either basal resprouters or reseeders had thinner bark. With increasing aridity there was a shift in dominance from epicormic resprouters to thinner-barked shrub and mallee species that either basally resprout or are killed by fire. Pairwise congeneric species comparisons showed a consistent relationship of thicker bark under high fire activity. This same pattern also emerged from a multi-species comparison within the dominant tree genus *Eucalyptus*. Overall, for this system, species with thick bark at the sapling stage dominate where fire is frequent. Thus, we confirm that fire can be a major driver of plant traits in fire-prone drylands.

## Tracking recovery and vital attributes of flora species after severe wildfire, Warrumbungle National Park, north-western NSW

*Dr Penny Watson and Dr Elizabeth Tasker, Office of Environment and Heritage, NSW*

Warrumbungle National Park in north-western NSW is an iconic part of the state's reserve system. Bordering the semi-arid zone, this park hosts a diverse plant complement mediated by its varied geology (volcanic and sedimentary), topography, and climate. In January 2013 almost 90% of the Park burnt in a single bushfire event, mostly under extreme conditions. This fire, unprecedented in the history of the Park, was followed by flooding rains. The combination of these two events raised concern about impact on the Park's biota, but also provided a rare opportunity to study vegetation response. Long inter-fire intervals – it had been over 40 years since the previous fire over much of the burnt area – added a further noteworthy element to the scenario. Through 2014 and 2015 we collected data on regeneration mode and/or time to first flowering on over 500 species in and around the Park. Vegetation response was rapid and vigorous, with a high diversity of species and life-forms, even on steep slopes where erosion may have occurred.

All grasses, graminoids and forbs appeared to have seeded by the second year post-fire. By the third Spring, most shrub species had also commenced flowering; this included many obligate seeders on rocky slopes. While most tree species resprouted, two native pines, conspicuous prior to the fire, were killed by 100% leaf scorch; post-fire, pine seedlings were abundant but slow-growing. Several shrubs rarely recorded prior to the fire became prominent, while some species commonly recorded pre-fire were less abundant. Overall, the picture was one of resilience, and sequential use of post-fire resources by different species groups. The local applicability of state-wide fire frequency ranges, recommended to minimise extinction risk for plant species, will be considered in the light of data and insights from this and companion studies.

## Fire effects on pollinators and pollination

*Julian Brown (S) and Associate Professor Alan York, University of Melbourne, Vic*

Increased incidence of landscape fire and pollinator declines with co-extinctions of dependent plant species are both globally significant. Interactions between fire, pollinators, and pollination are poorly understood, though the limited available evidence suggests they are important. I present a conceptual model of these effects and then describe empirical work exploring the ideas underlying this model. The central idea is that fire can influence plant-pollinator interactions through multiple processes operating over different spatial scales, and this was supported by the empirical work.

## Long-term effects of frequent fire on above-ground carbon stocks and vegetation structure in a wet sclerophyll forest in south-east Queensland

*Dr Tom Lewis and Professor Chenrong Chen, Department of Agriculture and Fisheries and Griffith University, Qld*

Forests play an important role in the global carbon cycle, but our understanding of the effects of fire on ecosystem carbon stocks is poor for eucalypt forests. To help improve this understanding, we utilised the Peachester fire experiment, which is one of the longest running fire experiments in the country. The experiment has treatments of biennial burning, quadrennial burning and no burning, dating back to 1972. At this experiment we assessed: (1) changes in the overstorey vegetation (DBH  $\geq 10$  cm) carbon stocks through time; (2) current above-ground carbon stocks for trees, understorey vegetation, coarse woody debris and fine debris; and (3) investigated changes in vegetation structure and composition over time. Average total above-ground carbon stocks varied from 229 t/ha in the biennial burnt treatment to 252 t/ha in the long unburnt treatment. Most carbon was stored in the live standing trees  $>10$  cm DBH (160-234 t/ha).

There was no difference in total carbon stored in the live standing trees ( $\geq 10$  cm DH) between the frequently burnt and unburnt treatments, and there was no significant difference in the growth rates of trees between treatments from 1969 to 2012. However, there was a decline in tree density in the biennial treatment over time, a relatively constant tree density in the quadrennial treatment, and a slight increase in density in the unburnt treatment over time. The relatively minor pool of understorey trees (dbh  $>2.5$  cm but  $<10$  cm) was also influenced by frequent burning; with significantly lower carbon stocks in the biennially burnt treatment than in the unburnt treatment. However this pool is expected to recover quickly if fire is removed for some period of time. Understorey composition and structure was strongly influenced by the fire treatments but these modifications had a minor impact on total ecosystem carbon stocks.

## Fire ecology of Brisbane's eucalypt forests

*Dr Paul Williams\*, Dave Kington<sup>^</sup>, Michelle Nash, Chandra Wood and Eleanor Collins, Vegetation Management Science\*, Queensland Parks and Wildlife Service<sup>^</sup> and Brisbane City Council, Qld*

Eucalypt forests dominate the Brisbane region, growing on a range of geologies, especially metamorphic, granite and sandstone derived soils. The most common regional ecosystem across the Brisbane region is RE 12.11.5, which is dominated by spotted gum, ironbarks and stringybarks on metamorphic-derived soils on hills and ranges. The Brisbane eucalypt forests benefit from regular, low intensity fires with good soil moisture. This type of burning promotes a diversity of native grasses and herbs, with an open forest structure. The eucalypt forests are dominated by plants that survive fire via resprouting, often with fire-promoted germination.

The minor number of obligate seeders are primarily short lived herbs and shrubs that mature to produce seed within 2 to 4 years. In all but very dry years, fire promotes an increase in species richness, due to the germination of a range of grasses and short lived herbs. Fires open up the mid strata by causing many saplings to coppice from ground level. Moderate to high intensity fires during dry conditions, especially in the August to October period, can promote an overabundance of seedlings of wattles and other legume shrubs; while negatively impacting on grass cover and the survival rate of mature canopy species. Fire intervals of < 6 years can maintain dense native grass cover; and a sequence of regular fires can be required to reinstate grasses cover. Significant weeds of Brisbane eucalypt forests include exotic grasses, Camphor laurel, Chinese elm and both Lantanas. Post-fire herbicide treatment can be of value in managing these weeds. Key issues relating to the condition and fire management of these forests include the role of fire in allowing regrowth forests to mature and prioritising burns in areas that remain in good condition - that is, areas with an open structure with good native grass cover.

## Vegetation boundary dynamics and relationships between fire severity and recruitment in a fire-sensitive heathland in the Gibson Desert

Boyd Wright, Northern Territory Herbarium, NT

In the vast dunefields of the Gibson Desert, large stands of fire-sensitive *Aluta maisonuevei* (Myrtaceae) heath occur within matrices of highly fire-prone grassland dominated by various species of *Triodia* (spinifex grasses). Despite anecdotal reports that *Aluta* stands are frequently subjected to high-severity burning, there is uncertainty about whether boundaries between *Aluta* and spinifex vegetation are stable and maintained by edaphic differences, or dynamic and possibly mediated by fire effects. We examined spatio-temporal data consisting of aerial photography from 1953 and satellite imagery from 1973 to 2016 to explore the stability of *Aluta-Triodia* boundaries over time. We also tested soil samples to investigate whether edaphic factors could explain *Aluta-Triodia* mosaics.

To explore mechanisms that enable the persistence of *Aluta* after fire, we examined rates of seed set and seed bank densities in unburnt communities, conducted germination trials on seeds to test for smoke- or heat-stimulated germination, and monitored recruitment after fires of differing severities. We found that small-scale boundary shifts occurred in the study area over the study period, and these shifts were associated with widespread fires that occurred during 2000-01 and 2012-13. Seed set of the examined *Aluta* flowerings were low, ranging from 1-5%, while seed bank densities were high, and appeared sufficient to offset adult mortality after fire. A strong relationship was also detected between seedling recruitment and fire severity, with increased recruitment after high- compared to low-severity burning, but no recruitment in unburnt habitat. Although *Aluta-Triodia* boundaries are somewhat labile, *Aluta* avoids extinction in flammable landscapes by suppressing fuel growth in long unburnt stands, and recruiting from fire-cued seed banks after high-severity burning.

## Theme 5 Fire, Soil and Climate Change

### Comparing smoke pollution from prescribed and wildfires: do we have a problem?

**Dr Owen Price, Bronwyn Horsey and Phil Purdam, University of Wollongong and the Bureau of Meteorology, NSW**

Smoke pollution from landscape fires is a major health issue. Intentionally burning landscapes to reduce the impact of subsequent wildfires is a well-accepted technique in Australia that is being increasingly used in other flammable landscapes globally. In SE Australia it has been shown that to effectively reduce the area burnt by wildfire around three times as much land needs to be treated with such 'prescribed' fire. Such large-scale prescribed burning raises the question as to whether the smoke pollution from prescribed fire is substantially different compared to wildfires.

We measured the maximum height and area of smoke plumes from 230 landscape fires (97 wildfires and 126 prescribed fires) in southeastern Australia using the existing network of weather radars. We found that plume height was well predicted by fire area, the C-Haines Index of atmospheric stability and fire type, with prescribed fires being 800-1200 m lower controlling for fire size. Six plumes were >9000 m high, four of which occurred on Black Saturday (7/02/2009) and the highest was 15127 m. Plume area was predicted by the same variables but with lower accuracy. Wildfires produced plumes 4 times larger than prescribed fires with the same extent, and the largest wildfire plume was 991,000 ha (State Mine fire, 16/10/2013).

We also measured particulate levels surrounding two prescribed fires near Wollongong in 2015. The larger fire (700 ha) produced a plume that reached 2000 m in height and spread 14 km downwind. The plume collapsed overnight producing pollution over an area of ~120,000 ha, an event that was not predicted by smoke plume models.

Prescribed fires have the potential to cause serious local and even regional pollution events, but not so much as wildfires of the same size. In the long-term smoke exposure to the human community may be similar under fire regimes dominated by either wildfire or prescribed fire.



## Combating wetland burning – The ability of carbonate to suppress combustion of organic soils

*Valerie Densmore, Department of Parks and Wildlife, WA*

Wetland fires pose considerable hazards to biodiversity and human health, and thus constitute a serious national and international issue. Wetland soils are rich in organic material, or peat, several centimetres to metres deep in a low-oxygen environment. When organic-rich soils dry sufficiently to ignite, below-ground fires produce toxic emissions and promote char formation, high temperatures and a propensity for flare-ups and reignition of above-ground fuels over many months.

The Swan Coastal Plain (SCP) encompassing Perth, Western Australia, contains >4,000 wetlands that are experiencing a drying trend and are susceptible to fire. A previous comparison between historical fire records and chemical analysis of wetlands hypothesised that high carbonate contents might absorb latent heat and inhibit combustion of peat. To test this hypothesis, peat was sampled from nine wetlands classified as low, medium, or high carbonate concentrations.

Total weight loss was measured following combustion of samples at air-dry, 10% and 20% (w/w) moisture. In a second experiment, commercial peat samples were mixed with 0, 30, or 60%  $\text{CaCO}_3$  or 30%  $\text{NaCO}_3$ , burned at dry, 50% and 100% (w/w) moisture, and weight loss recorded as before. Finally, weight loss was measured from wetland soil samples that were ignited and then 'extinguished' using water, aqueous suspensions of 30 or 60%  $\text{CaCO}_3$  or 1.5% bushfire-fighting foam. Repeated measures ANOVA suggested adding  $\text{CaCO}_3$  either before or after ignition significantly decreased the total amount of peat combusted. These results confirm higher  $\text{CaCO}_3$  concentrations decrease the flammability of peat and suggest a key role for carbonate-based extinguishing agents and delivery systems.

## Interactive relationships between fire frequency, insects and elemental cycling in Peachester State Forest

*Orpheus Butler (S), Professor Chenrong Chen, Professor Brendan Mackey, Dr Tom Lewis\* and Professor James J. Elser, Griffith University and the Department of Agriculture and Fisheries\*, Qld*

Fire and fire frequency can have considerable impacts on the structure and function of forest floor invertebrate communities. At the same time, fire can alter the biogeochemical cycling of carbon (C), nitrogen (N) and phosphorus (P) in forest ecosystems. However, the potential interactions between these effects have rarely been investigated. We conducted two experiments in the long-term prescribed burning trial at Peachester State Forest to determine (a) how fire frequency affects litter fauna communities, (b) if these effects are related to fire-altered litter C:N:P ratios and (c) whether these effects are linked to the processes of litter decomposition.

Preliminary results show that litter N:P ratios are significantly lower in the most frequently burned treatment, and that litter N:P regulates Coleoptera (beetle) abundance when estimated using pitfall trapping methods. However, the abundance of most insect orders was not altered by frequent fire, suggesting highly-resilient communities after ~40 years of biennial burning. Further, frequent fire appears to have enhanced the role of invertebrates in litter decomposition during mid-stage decomposition (30 days).

This effect was reduced in later stages (60-180 days), however, and the unburned treatment at Peachester had significantly higher decomposition rates over the entire decomposition period. These initial findings suggest that invertebrate communities may have adapted to the frequent burning at Peachester, and that some orders may have come to benefit from the low litter N:P ratios brought about by biennial burning. In addition, frequent burning appeared to inhibit litter decomposition despite greater contributions from invertebrates to rates of litter mass-loss. Overall, these results hint at a complex and interactive relationship between fire, insects and biogeochemical cycling in this forest ecosystem.

## Environmental determinants of grass and shrub cover across a transitional climate region: Implications of climate change on fuel dynamics

**Dr Rebecca Gibson and Professor Ross Bradstock, Office of Environment and Heritage and the University of Wollongong, NSW**

The relative mix of grasses and woody plants within a community is likely to have a strong influence on the nature of fire regimes, given the different patterns of growth and flammability between the life-forms. Climate change may influence fire regimes via effects on the relative growth responses of grasses and woody plants to changes in temperature, moisture and CO<sub>2</sub>. Previous research in the Mediterranean region of south eastern Australia indicates that temperature is a primary control on the present-day distribution of the perennial hummock grass, *Triodia scariosa*. An increase in temperature in the future may be expected to promote the southerly expansion of *T. scariosa*, depending on relative responses of plants in the shrubland communities.

This study aimed to experimentally determine the relative influence of temperature, moisture, soils and CO<sub>2</sub> on the growth of *T. scariosa*, and two common woody shrub species that occur across the range of *T. scariosa*, *Acacia ligulata* and *Leptospermum coriaceum*. The results indicate that *A. ligulata* and *T. scariosa* exhibited strong tolerance for dry conditions, with *L. coriaceum* being relatively less tolerant of hot, dry conditions. *Triodia scariosa* had relatively greater growth under higher temperatures, which was predicted given the higher water use efficiency of the C4 photosynthetic pathway under hot temperatures. Interactions between climate factors, CO<sub>2</sub> and soils added complexity to growth responses in some cases. Nonetheless, the results suggest there is the potential for a southerly expansion of *T. scariosa*, with a corresponding decline of the less drought-tolerant shrub species. Changed fire regimes due to an increase in *T. scariosa* cover, relative to woody shrub species, may transform community states from the highly diverse Mediterranean-type vegetation (temperate mallee heathlands) to semi-arid mallee woodlands in the future.

## Estimating air emissions for natural fires in south east Queensland

*Rhiannon Tooker and Robin Smit, Department of Science, Information Technology and Innovation, Qld*

DSITI has conducted a research project to estimate the contribution of fire emissions to air pollution loads in South East Queensland. Emissions are a function of fire type (agricultural, bushfire, prescribed), fuel load (i.e. amount of material burned), fuel type (i.e. type of material burned, e.g. grass, forest) and characteristics (e.g. fraction burned, dry matter), area burned and ambient conditions (e.g. temperature, humidity, wind speed, rainfall). This paper describes the method used to create an updated air emission inventory for SEQ, including consideration of spatial and temporal distribution of emissions. Emissions from agricultural burns are concentrated in specific periods of the year for certain crops. Similarly emissions from bushfires generally occur in the spring and summer months, and emissions from prescribed burns mostly occur in winter and spring. Previous work in SEQ and NSW (for different base years) shows a large difference in the percent contribution to total emission loads, which illustrates the year-to-year variability in fire emissions. For instance, bushfires are highly dependent on meteorological and fuel conditions and do vary greatly year-to-year. Prescribed burns are also dependent on these variables, as well as public and policy support for controlled burns. Agricultural burning for sugarcane has decreased across Queensland from 76.4 per cent of the total crop harvested with burning in 1990 to 31.7 per cent in 2007. Estimated emissions of CO, NO<sub>x</sub>, SO<sub>2</sub>, PM<sub>10</sub>, PM<sub>2.5</sub> and VOCs are more than 600 per cent greater than emissions recently estimated from fires by NSW EPA. This large difference is largely due to the difference in area burned by each fire type. Over 30 times more area was burned by bushfires in South East Queensland than NSW. Similarly, agricultural burns covered twice as much area in South East Queensland than NSW. However, prescribed burns covered 40 per cent less area in South East Queensland than NSW.

## Initial findings on the Bushfire Convective Plume Experiment: Examining Pyroconvection with Portable Radar

*Nicolas McCarthy (S), University of Queensland, Qld*

Convection on the scale of hundreds of metres to kilometres coupled to bushfires present challenges to both wild and controlled fire management efforts in Australia. By making use of portable Doppler radar with dual-polarisation technology and weather balloons, the Bushfire Convective Plume Experiment sought to collect the first observational results of fire-related convection in an Australian context, with an emphasis on the formation processes of pyrocumulus and pyrocumulonimbus.

In the 2015-2016 fire season in south east Australia, the experiment obtained the first results observing convection above two wildfires in Victoria. Following this, observations were made at two prescribed burns in southern Queensland through the early winter prescribed burning season. The results indicate numerous flow features related to the convection observed at an unprecedented scale both temporally and spatially from each of the fires. These results are compared for the first time in the context of the convective environment on each of the day as well as with respect to fuel and fire intensity conditions. These findings provide the proof of concept for the use of such a methodology to be expanded to examine other pressing questions of fire behaviour related to convection, such as spotting and plume collapse.

## Theme 6

### Maps and Models: Intelligent Fire Planning

#### Can thermal imagery help inform landscape fire management and planning?

*Shannon Mooney and Mik Petter, Healthy Waterways and Catchments, Qld*

Thermal imagery is now more accessible with satellites collecting this information at varying scales across the globe. SEQ Catchments acquired Landsat 5 Imagery for 2011 towards the SEQ Natural Resource Management Plan. This imagery is used across the State for Vegetation Monitoring. Landsat 5 imagery is 30 m multispectral with different bands presenting information on soils and vegetation, with the infrared band used for thermal mapping and estimating soil moisture. These individual bands provide relevant information, and when combined present a snapshot of cooler and hotter parts of the landscape. We selected a mix of infrared bands that provided best resolution of thermal signature of shade, soil moisture and water bodies. The data can show that different parts of the forest have varying thermal signatures, but generally are cooler than non-forested areas. Gullies and streams are coming up cooler within the forest because of soil moisture and other properties.

Along waterways, different temperature signatures have been noticed based on presence/absence of vegetation. Across some water bodies, we did pick up varying temperatures with depth possibly playing a role. Riverine vegetation are cooler parts of the landscape and within suburbia provide for climate refuges.

In a rural landscape, thermal signature varies across grazing and cropping lands. Floodplains and wetter soils are showing a cooler signature. Grassy areas on western facing slopes are hotter, but also the data is showing a hotter signature in some landscape particularly on northing and eastern facing slopes. Southern facing slopes in SEQ are generally cooler. The next phase is to evaluate this information with landholders and practitioners and to see if it would be useful to start collating a time series product.

## TERN: Data Infrastructure that enables fire management

*Associate Professor Nikki Thurgate, Dr Siddeswara Guru and Professor Tim Clancy, Terrestrial Ecosystem Research Network and the University of Queensland, Qld*

The Terrestrial Ecosystem Research Network (TERN), funded through the Australian Government National Collaborative Research Infrastructure Strategy (NCRIS) has developed data infrastructure to enable ecosystem researchers to collect, collate, contribute, store, share and integrate data across different ecosystem domains for the needs of national and international research activities. The strategic goal of TERN is to provide open access to Australia's ecosystem science research data and contribute to the deeper understanding and long-term sustainable management of Australia's ecosystems. This initiative has enabled a coordinated approach to transforming how the ecosystem science community collects, stores, shares, re-uses and analyses heterogeneous datasets of various spatial and temporal scales to harness their collective power.

Data published by TERN has a huge impact on the study of the fire across Australia. For example, TERN collects and publishes monitoring data in fire impact regions in Northern Australia and Alpine areas of Victoria. Researchers have used some of the datasets to study, for example, effects of fuel reduction burn on soil greenhouse gas exchange, to understand the relationship between fire and the movement and storage of carbon, and develop a framework to evaluate the impact of climate and environmental variables on fire regime. The TERN infrastructure has also assisted in providing data to Sentinel (a web-base fire mapping sites) and NAFL (Northern Australia Fire Information). This presentation will provide information about some of the fire related datasets collected and published by TERN partners and use of these information for the effective management of fire.

## Science in practice: application of ecological metrics in strategic bushfire management planning

*Imogen Fraser and Andrew Blackett, Department of Environment, Land, Water and Planning, Vic*

Building the health of Victoria's environments is a fundamental tenet of Victoria's Safer Together policy, which outlines the State's new approach to managing bushfire risk. With respect to building the health of environments, the primary objectives of bushfire management on Public land in Victoria are two-fold: (i) to minimise the impacts of major bushfires on the environment; and (ii) to maintain or improve ecosystem resilience. The integration of science into bushfire management policy and decision making, and the adoption of a strategic, risk-based approach to planning are critical to achieving these objectives. To this end, the Department of Environment, Land, Water and Planning has developed a policy position that describes the way the Department considers environmental impacts and measures ecosystem resilience in relation to bushfire management. The policy was initially developed based on a major review of resilience concepts and their measurement for fire management. The review recommended three measures to monitor and predict ecological responses to fire, which have been adopted by the Department and are now used to inform planning of strategies to manage bushfire risk to ecosystems. These include: tolerable fire interval, geometric mean abundance of species in a community and vegetation growth stage structure. Here, we outline these metrics and describe how they are applied within DELWP's strategic bushfire management planning framework. We also discuss the role of research in the development of the ecosystem resilience policy, with reference to several research projects currently underway to progressively test and refine the metrics and ecological management model.

## Modelling optimal growth stage distributions for biodiversity observation and ecosystem resilience

**Matthew Chick (S) and Associate Professor Alan York, University of Melbourne, Vic**

Prescribed fire is a necessary tool for mitigating wildfire risk through managing forest fuels. As well as fuel management, attempts to use prescribed fire as a tool to protect and promote biodiversity are occurring through burning a patchwork or mosaic of age classes throughout the landscape. The concept behind mosaic burning is to promote landscape resilience through achieving a diversity of age classes across the landscape, and therefore a diversity of species compositions in differing successional stages.

Furthermore, after the 2009 wildfires in Victoria a bushfire royal commission recommended increasing prescribed burning to around 5% of public land per year. Currently land managers are uncertain what the ideal proportion of age classes across landscapes is, and what increased prescribed burning will mean for current plant species compositions. To address this gap, we have parameterised the landscape succession and disturbance model LANDIS-II to attempt prediction of future landscape change under alternate wildfire management scenarios. This has occurred using data from a heavily managed Heathland community. Scenarios included burning 5% of public land as recommended, burning the current amount of around 1.7%, or burning an in between amount of 3%. Model results include resulting age class distributions and species richness after 50 and 100 years of each scenario. As age class management is current practice, modelling such as this is important in order to build predictions under alternate scenarios and help inform land managers.

## Fire is not fire – The next generation of TERN fire remote sensing datasets

**Stefan Maier, Terrestrial Ecosystem Research Network and the University of Queensland and Maitec, Qld**

In Australia fire is a key ecosystem disturbance factor. Fire extent mapping has become a routine application for satellite remote sensing. Therefore TERN has been providing a number of fire extent and derived products since its beginnings.

However, fire is not fire. Fires differ widely in their ecological impact, fraction of fuel consumed, severity, patchiness and amount of greenhouse gases released. Some fires only affect the understory – others affect the canopy as well. TERN's next generation fire remote sensing datasets are capturing and quantifying these differences. This presentation will introduce these new datasets and explain their relation to field measures. It will also discuss accuracies, advantages and limitations.

## Playing with fire: The disparities with observed and model predictions of fuel loads

*Dr Diana Virkki, Ten Rivers, Qld*

Effective bushfire risk reduction requires a detailed knowledge of the key inputs and landscape influences that underpin bushfire hazard, including fuel availability; a strong influencing factor of fire behaviour and severity. Fuel profile data for Qld, including accumulation and retention data, is currently lacking. This project investigated fuel accumulation and retention rates in spotted gum open forests to woodlands (BVG 10) within southeast Qld. Our aim was to increase our confidence in the underlying equations and assumptions describing accumulation and retention rates. A combination of destructive and visual assessment was employed across 22 locations with varying time since fire in order to capture fuel accumulation over time. At the sampling locations, 3-5 transects were established and at each transect, fine fuels (<6mm) were collected within 3×0.25m<sup>2</sup> quadrats for drying and weighing, and 3 visual assessments were completed using the Overall Fuel Hazard Guide. Observed fuel (t/ha) was variable within and across sites but was fitted to a cubic curve in a significant relationship with time since fire ( $P<0.05$ ;  $r^2=0.36$ ) and appeared to plateau at 7-8 years post-fire.

This differed slightly from the fuel models used in the State Planning Policy for BVG 10, with a steeper accumulation and much earlier plateau in observed data. Surface and near surface fuel structure metrics were also significantly related to time since fire ( $P<0.05$ ;  $r^2=0.21-0.57$ ). The project provides valuable data towards determining variability within the fuel type.

This will directly improve the way we manage uncertainty in the inputs that are used in fire behaviour modelling. Understanding fire behaviour is critical to support decision makers and fuel is the single most important input to the fire behaviour triangle (weather/topography/fuel).



## Theme 7

### Fire Management for Linear Infrastructure

#### **Lines through the bush - Infrastructure corridors and fire management: An SEQ case study and factors to consider**

*Dr Mark Shuster and Paul Veivers, Meandu Mine, Qld*

With the current and future population growth in urban and regional South East Queensland, infrastructure corridors are a very evident component of our landscape, are 'here to stay' and are estimated to occupy between 8-10% of total area within the landscape. Infrastructure corridors have a critical role, particularly in terms of traffic movement, delivery of water, electricity and collection of waste products and other functions.

In terms of fire management, infrastructure corridors play a crucial role within the landscape. This presentation details a case study from the Tarong-Meandu region, located in the South Burnett district of SEQ, where power generation and delivery operations are located in large tracts of bushfire-prone vegetation within varying tenures (e.g. National Park, State Forest, State Government, private ownership). Infrastructure corridors are a major component of the operations and bushfire management planning has considered both the critical nature of these corridors and a multiplicity of fire management issues.

Factors to consider in holistic fire management, which are discussed in detail in the presentation, include: ignition and wildfire entry and damage to infrastructure from adjoining bushland tracts; ignition within the infrastructure corridor and wildfire spreading to adjoining bushland tracts; factors to consider when both planning and undertaking hazard reduction and risk-mitigation activities, both within and adjacent to the corridors; maintenance of appropriate fire regimes and biodiversity in a fragmented landscape and developing a bushfire management planning process in which infrastructure corridors are given a high level of relevance within the landscape.

## The Coordinated Agency Model for Improved Roadside Fire Management

*Julian Selke and James Haig, Department of Transport and Main Roads and Queensland Fire and Emergency Services, Qld*

In many parts of South East Queensland (SEQ) there currently exists conflict between private landholders wishing to conduct roadside hazard reduction burns (adjoining their property), local councils and other governing bodies due to a lack of process. Effective management of roadside reserves to help prevent damaging wildfire is essential in regional areas with high value agricultural properties and biodiversity values and will help maintain and establish productive and cooperative relationships between government and landholders. The Coordinated Agency Model comprises a proactive and cooperative approach to planned hazard reduction burns along roadsides from Toowoomba Regional Council, Queensland Fire and Emergency Services (QFES), Department of Transport and Main Roads and Queensland Parks and Wildlife Service (QPWS). Initially officers met through their participation in the Regional Inter-departmental Committee (RIDC) on Bushfire for the QFRS Southwest Region and ongoing interaction saw relationships develop over time. Requests to conduct a burn are received by the QFES via local Rural Fire Brigades and/or are assessed as a result of predetermined regional priorities. Importantly, this process allows private landholders to make a request via their Rural Fire Brigades. The Coordinated Agency Model addresses the issue of biodiversity by including QPWS in the assessment phase. It also deals with insurance concerns by having QFRS staff and volunteers conduct burns. This process has only been operating at its present level since September 2011, but in this short time has demonstrated enormous success. In theory, it can be applied to all local government areas across SEQ, provided key staff can be identified and there is a willingness to work together. It provides an excellent opportunity for local governments to achieve efficient and safe roadside corridor hazard reduction burns, whilst maintaining community trust and biodiversity values. The Coordinated Agency Model offers great potential for addressing the issue of roadside burning and community engagement, whilst minimising insurance risk to councils.

## Corridor fires: What's different?

*Dr Leasie Felderhof, Firescape Science, Qld*

Managing fires along linear corridors adds complexity for those responsible for day-to-day management. Powerline, roadside, railway-line and pipeline corridors criss-cross Queensland and each use has associated issues for managing fuel loads. In all cases, managing organisations aim to reduce the risk of wildfires. This presentation will draw upon powerline and roadside examples to highlight approaches to fire management that differ from the typical 'block-of-land, broad scale fire management' methods used by most landholders. Key differences are:

- (i) a multitude of neighbours with different opinions and land-uses,
- (ii) organisation charters (and cultures) that recognise natural resource management, but do not have a specifically trained work-force to assign (as it is not core-business), and
- (iii) where infrastructure is on land owned by others, with tenure secured through easement arrangements. Communication and clear organisational processes are essential for achieving outcomes; also, to make best use of limited fire management resources, a strategic approach is required.

## **Mahogany Glider movements near linear infrastructure**

***Ben Saal, Powerlink, Qld***

Mahogany glider (*Petaurus gracilis*) habitat in an area of known high value is fragmented by linear clearings including a high voltage transmission line easement. Powerlink funded research into in order to increase understanding of mahogany glider habitat and habitat use to assist in reducing the impact of the powerline, including reducing the impact of a powerline upgrade.

The research had two main areas of focus. Firstly, remnant vegetation of known mahogany glider habitat was compared with vegetation regenerating within the easement corridor, with particular reference to vegetation attributes important to the mahogany glider. Secondly, a detailed observational and radio tracking study of mahogany glider habitat use was conducted within and around this remnant and easement vegetation in order to understand how they use habitat fragmented by a transmission line easement and whether vegetation changes around powerline clearings influence their behaviour and habitat use.

## **Electrical impacts of bushfires on transmission lines**

***Tony Gillespie, Gillespie Power Consultancy, Qld***

The passage of bush fires under or near transmission lines can cause outages. To assist with understanding how fires under or near transmission lines cause outages, this paper considers the electrical aspects.

Air heating by the fire effects the electrical conductivity of air. Furthermore, ionised gases and conductive particles from bushfires can cause a flashover between conductors and between conductors and ground. Based on the electrical withstand of air, minimum air gaps required to prevent fire flashover are presented. These can be used to set an upper limit on vegetation height under transmission lines.

Conductor heating due to nearby bushfires has been modelled. The fire causes increased ambient temperature and radiant heating which results in increased conductor sag and reduced ground clearance. Results for modelling time to reach maximum conductor operating temperature and minimum statutory ground clearance will also be presented. Based on model results, vegetation fuel load near transmission lines can be set to reduce the risk of outages due to bushfires.

## The Tasmanian Bushfires of 2013 - An Environmental Response

*Michael Emmett, Tasnetworks, Tas*

On the 3rd and 4th of January, a heat wave, which covered most of the southern and eastern portion of the Australian continent, combined with strong winds and low humidity caused a number of fires to spread across Tasmania. The 4th of January saw Hobart achieving its highest temperature since records began in 1883, reaching 41.8°C (107.2°F) at 4:05 pm. As of the 5th of January, up to 40 fires were burning across Tasmania. The worst of the bushfires (known as the 'Inala Road, Forcett' fire), destroyed at least 100 properties, including 65 at Dunalley where the police station, primary school and bakery were destroyed, 15 at nearby Boomer Bay, and 14 at Sommers Bay. More than 21,000 hectares of bushland was burnt out as a result of this fire alone. Significant electrical infrastructure damaged included:

- 620 poles lost
- 100km of wire down
- 75 pole mounted transformers destroyed
- 3400 customers without power

This presentation focusses on the resultant health, safety and environmental issues encountered including the ensuing clean-up process. Issues included: clearing thousands of burnt and dangerous trees; clean-up of 15 'wet' oil spill sites; movement of contaminated soil; management of CCA ash from burnt poles; managing wildlife and farm animals; asbestos issues; threatened species issues; recycling of materials; management of temporary generator sites. The presentation also discusses key lessons learnt.

## Theme 8 Fire and Land Management

### Reflections on the NSW Bush Fire Environmental Assessment Code since 2006: Continuing to meet the need

*Dr Simon Heemstra and Jennie Cramp, Rural Fire Service, NSW*

Navigating environmental approval pathways to meet, what is often seen as the competing objectives of bush fire risk reduction and environmental protection has been one of the ongoing wicked problems facing fire managers. In NSW, the Rural Fires Act 1997 (RF Act) provides for a streamlined environmental approval process to undertake bush fire hazard reduction work through the Bush Fire Environmental Assessment Code (the Code). This reduced the need to navigate up to 22 different pieces of legislation to approve works. The Code has been utilised by the NSW Rural Fire Service, other fire agencies and land managers across NSW since 2003 and was significantly amended in 2006.

The current 2006 Code allows certificates, validating hazard reduction works to be issued in accordance with described conditions for prescribed burning and certain mechanical works including slashing, trittering and tree pruning to create asset protection zones. Since this time, a number of wildfire events have necessitated inquiries into the NSW hazard reduction programme. The current review of the Code responds to resulting amendments in the RF Act, including proposed provisions for the establishment and maintenance of fire trails.

The review also seeks to update the science base underpinning the Code and respond to impediments raised by stakeholder groups. It is critically important that the Code can continue to operate across tenures and be the backbone in ensuring that environmental considerations underpin risk-based hazard reduction treatments. This presentation provides an overview of the Code's implementation since its inception, including the challenges, gaps and future developments

## National Burning Project

**Deborah Sparkes and Greg Esnouf, Australian Fire and Emergency Service Authorities Council, Vic**

Prescribed burning is carried out in Australia to achieve a number of objectives and the value of prescribed burning in reducing risk of bushfire and protecting ecological values is well recognised. There are multiple land managers across Australia that utilise prescribed burning under various legislative, policy and planning requirements. Over the years there have been recommendations to develop national principles (e.g. Ellis et al, 2004) around prescribed burning. AFAC and the FFMG have undertaken to address this recommendation through the National Burning Project (NBP). The project is bringing together inter-related aspects of prescribed burning across Australasia to clarify objectives and design guiding frameworks and principles for a more holistic and consistent approach to prescribed burning practices. The benefits of a national framework lie in the greater authority that comes from accessing the best available guidance, greater economy of establishing a single view and greater interoperability with common standards and approaches.

Developing these national standards and approaches has taken extensive consultation across agencies and jurisdictions and has fostered shared knowledge and networks amongst those that strategize and operationalise prescribed burning objectives. The project also aims to aid in communicating these approaches to the wider public to gain acceptance of the science and practices that underpin prescribed burning programs. The consultation phase has brought together agency staff, not just from the public fire and emergency sectors, but private enterprises that also engage in land management through the use of fire.

In this conference presentation we outline the key features of the NBP and highlight it as a case study for effective cross agency consultation and agreement on deriving common principles around a multi-faceted operation.

## Using prescribed burns to achieve biodiversity outcomes through weed management

**Dr Kirsten Abley and Anthony Abley, Department of Environment, Water and Natural resources, SA**

While the primary purpose of prescribed burning is usually to minimise the risks that bushfires pose to human life and property, there are often opportunities to achieve ecological benefits from prescribed burn programs. In the Mount Lofty Ranges of South Australia, areas that are subject to prescribed burning are also often those that are degraded by weeds due to their proximity to urban areas. Managing fire-responsive weeds is therefore a significant challenge from a fuel and biodiversity management perspective.

The Department of Environment, Water and Natural Resources are undertaking trials and using adaptive management to determine how they can use prescribed burns to their advantage to manage weed infestations. Preliminary results from two recent trials involving the control of *Erica arborea* and *Watsonia meriana* have found that prescribed burning can increase the efficiency of weed control and the recovery of the previously out-competed native vegetation. The results from these trials also highlight the potential benefits of using pre-fire weed control to increase the effectiveness and efficiency of post-fire follow-up.

## Ecological ignitions: Suggestions on how to ignite ecologically beneficial fire in subtropical and tropical eucalypt forests

*Dr Paul Williams, Vegetation Management Science, Qld*

Regular fire maintains healthy subtropical and tropical eucalypt forests, with long fire intervals associated with the loss of grasses and forbs. The development of fire regime guidelines for ecosystems, including how often and in which season planned burning is most appropriately implemented, has progressed ecological burning. However, exactly how a fire is ignited, and under what weather conditions, makes a considerable difference to fire behaviour and the ecological outcomes of a burn. If not ignited correctly, fires can cause ecological damage even if they are of ecologically sound intervals and in appropriate seasons. Damage from inappropriate ignitions can include crown death, excessive recruitment of legume shrubs or insufficient patchiness. Rapid ignition of continuous fire lines, and burning upslope, produce considerably higher fire intensities with lower patchiness than spot and ridge top ignitions.

Ignition pattern can affect scorch height and therefore crown health of old trees, the density of shrub recruitment, the regeneration of weeds, grass tussock survival and recruitment of grasses and forbs. All of these responses can influence fuel dynamics of subsequent fires. Multiple ecological benefits can be achieved by targeting ignition patterns to clear objectives within the landscape. Rapid and long line ignition can increase fire intensity to manage woody weeds, while spot ignitions can be more effective at achieving a patchy burn to maintain grassy forests. Rainforest protection can best be achieved by igniting spots of fire in eucalypt forest near a scrub edge, rather than allowing a fire to run towards the rainforest from a distance.

## Red Hot Tips: Building capability and capacity of private landholders to conduct planned burning

*Leanne Sherriff and Justin Cashion, Macquarie Franklin and Ground Proof Mapping, Tas*

Tasmania has recognised that government agencies have insufficient capacity to conduct planned burning across all land tenures in the State. It has also been recognised that there is a declining trend of private landholders conducting planned burning on their properties. This has been driven primarily by a fear of fire escapes and subsequent litigation, but also by limited resources (people and equipment), and confidence. Red Hot Tips is a Tasmanian State Government funded project with a key objective to upskill private landholders and increase their capability and confidence to conduct safe and effective native vegetation burns on their land. Over four years the program has developed fire management plans for 70 properties and engaged over 100 people in training activities. Red Hot Tips utilises a supported learning model, to help participants build skills and confidence.

Participants are taught the theory of fire and planned burning, develop a property fire management plan with an experienced fire consultant, and then the theory is put into practice by participating in a planned burn in their region. The program has also developed tools and resources for landholders, including a theory manual, risk assessment template, and case studies of the project burns. Program evaluation to date indicates 50% of participants have conducted more burning since participating in the program. There is a strong relationship between time since completing the program and amount of burning conducted. All participants indicated that the program enhanced their confidence to conduct planned burns.

## Fire behaviour in buffel grass dominated mine site rehabilitation in central Queensland, Australia

*Dr Phill McKenna and Dr Peter Erskine, University of Queensland, Qld*

Rehabilitated lands created by open-cut coal mines in Queensland are generally protected from fire and grazing disturbances to reduce negative impacts, such as erosion, on the developing ecosystems. As a consequence, fire could be a major risk to such communities, particularly when high biomass, mono-dominant grasses form a major component of these new ecosystems. In May 2015, an experimental fire burnt over 117ha of rehabilitation at a coal mine site in Central Queensland's Bowen Basin. Ground fuel loads were dominated by Buffel grass, with calculated biomass loads of 9.3t/ha in areas dominated by grassland and 5.3t/ha in areas of open woodland. Fire intensity was higher in grassland transects ( $4,612 \pm 502 \text{ kWm}^{-1}$ ) than open woodland transects ( $1,977 \pm 804 \text{ kWm}^{-1}$ ) indicating that rehabilitated landscapes dominated by Buffel grass are a substantial fire risk to mine sites and regional areas in the Bowen Basin. Fire behaviour was variable and reflected the underlying terrain, fuel loads and rehabilitated soil media conditions.

## The effect of fire and rainfall in gross primary productivity in northern Australian savannas

*Barbara Bernal (S), Dr Andrew Edwards and Professor Lindsay Hutley, Charles Darwin University, NT*

Primary productivity in the northern Australian savannas has been measured for its potential for carbon storage; different variables can affect how vegetation responds and therefore its ability to store carbon. Many studies have noted the differences in rainfall, primary productivity and fire along the Northern Australian Tropical Transect (NATT), but lack the ability to compare the relationship of the three. Spatial data on fPar, fire and rainfall was obtained along the NATT to compare these three variables from 2009 to 2014.

The results of this study support the rainfall latitudinal gradient, with higher fire activity as result of higher primary production following increased annual rainfall. While the medium and lower zones of the gradient show a lower and more variable response in primary production and fire with decreased annual rainfall; dependence in rainfall is observed after a peak in primary production and fire activity due the 2010-2011 rainfall anomaly. Significant results show that rainfall and fire affect the primary productivity of Northern Australian Savannas; finally understanding the effects that underpin the productivity of northern savannas is a necessary step toward proper land management in terms of carbon storage, through productivity and fire management relevant for different industries such as cattle, conservation and sequestration.



## Theme 9 Fire, Threatened Species and Conservation

### Fire management for conservation: Outcomes of AWC's fire programs across northern Australia

*Dr John Kanowski, Australian Wildlife Conservancy, Qld*

Australian Wildlife Conservancy (AWC) manages 25 wildlife sanctuaries, covering over 3.25 M ha, across Australia, alone or in partnership with government agencies. Our mission is the effective conservation of native wildlife and their habitats. Fire is a major ecological driver in many Australian ecosystems and altered fire regimes a key threat to many species; consequently, AWC purposefully manages fire for conservation outcomes on our sanctuaries.

In this talk, I present an overview of AWC's approach to fire management, using examples from northern Australia where our programs are most active. Issues to be discussed include:

- program logic, including the development of sanctuary fire strategies, annual plans and reports against key metrics
- the rationale for our approach, including the ecological evidence used to determine the objectives of management in particular sanctuaries, and how these objectives vary with ecological context (for example, between the Kimberley and north-east Queensland).
- how we balance ecological objectives with other objectives of fire management, including protection of life and property, given the range of social contexts in which we operate.

I present a range of case studies, showing how AWC has changed fire regimes on its sanctuaries and the consequences for wildlife. I discuss several regional fire projects led by AWC and the benefits that come from working at the regional scale. I conclude with some of the key challenges for AWC's fire management programs.

## How long is too long: The response of woody plants to inter-fire intervals in grassy forests of the Border Ranges, NSW

*Dr Elizabeth Tasker and Dr Penny Watson, Office of Environment and Heritage, NSW*

Interspersed with the rainforests of the Border Ranges in north-eastern NSW are open grassy eucalypt forests. These provide critical habitat for the highly endangered northern population of the Eastern Bristlebird and for the endangered Hastings River Mouse. These grassy forests have declined markedly in condition and extent in recent decades, concurrent with major declines in species dependent on them.

These changes appear closely tied to reduced fire frequency associated with land-use change. To identify the effectiveness of prescribed burns aimed at improving these habitats, in particular in reducing the abundance and vigour of invading shrubs and trees, we tagged 934 weed, wattle, eucalypt and rainforest plants on 11 transects across three sites. These sites have since been burnt experimentally, one recently, and we have collected data on regeneration so far at two sites after fires that followed 4.8 and 13.8 year inter-fire intervals, respectively.

At 7 months post-fire, woody plant numbers at the site with the recent short interval were 80% of those before the burn. In contrast, at the site with the recent long interval, there were four times as many woody plants as prior to the fire.

This result, in combination with other data, suggests that a single long inter-fire interval may be a key factor allowing woody plants to invade formerly grassy vegetation. We have identified regeneration modes for the main invasive species at these sites, and are using these to target vulnerabilities that might be exploited for habitat restoration. Sites that have had at least one long inter-fire interval in the recent past will require active management to restore them, in particular to reduce woody plant numbers. This may include one or more very short fire intervals and manual woody plant removal.

## Planning, implementing and evaluating fire management- Recurrent issues and responses in a range of environments

*Murray Haseler, Bush Heritage Trust, Qld*

BHA owns properties in Queensland for which fire management is anticipated, planned for, resourced and evaluated. BHA also works in partnership with indigenous people on their country on conservation programs. A lot of this work is with documenting planning. A number of projects have an active management project involving management of fire. We are over time developing a comprehensive checklist of considerations- sorting these into an approach, a set of documents and records and so hopefully developing and sustaining corporate knowledge and understanding. It is still a work in progress as we work across contrasting properties in different contexts. Projects and issues encountered include:

Vegetation structure as cultural artifact: With some trees living longer than colonization and removal of indigenous people and their fire management, many current features of the vegetation structure are persisting as cultural artifacts, as management artifacts. Fire management *nullius* still happens. Assumptions, explicit or otherwise, in fire management may compromise both ecological and cultural outcomes in some places.

Characterization of climate and weather variables and the landscape of soil moisture retention: The need for plans and evaluations to be long term and more comprehensive in the characterization of climate variables

The use of stock or facilitating heavier grazing by macropods as part of vegetation, weed and fire management. Some thoughts in progress on issues from western and central Qld.

Managing for weeds, amongst other things: Fire regimes can make things better or worse, and this can vary for different weeds. Siam and Grader grass in NQ. Implications for projects further north.

Managing native vegetation structure for threatened species. Last but not least. The return of indigenous fire management by the Ulkula people of Cape Yourka with the hope of bringing back the endangered golden-shouldered parrot. A project with all of the above.

With fire plans and evaluations for properties in the grey literature, I value the SEQ Fire and Biodiversity Consortium as a form of extolling, sharing, and best of all peer review by a wide span of people and positions involved with fire management. There will always be lots to resolve.

## Managing fire to help prevent the extinction of the Coastal Emu: A successful collaboration between Hotspots and a more traditional NRM project

*Mark Graham, Nature Conservation Council of NSW, NSW*

Located in the hinterland of Yuraygir NP east of Grafton and part of the most significant undeveloped coastal corridor in NSW, the Upper Coldstream catchment is one of the last strongholds of the Endangered Population of the Coastal Emu. It supports nationally significant wetlands, unique vegetation communities and one of the greatest diversities of threatened species in Australia. Currently about 110 species are known with more being identified on a regular basis as a result of ongoing biodiversity survey work.

The iconic Coastal Emu is the flagship species for the Upper Coldstream Biodiversity Project (UCBP). With massive declines in recent years the Coastal Emu is rapidly approaching extinction. There are strong indications that shifts in fire regime have played a role in this decline. These shifts in fire regime have driven major changes in vegetation structure, particularly contributing to landscape-scale changes from more open habitats to those with a dense shrubby understorey. Extensive invasion by *lantana* appears to be another consequence of shifting fire regimes.

UCBP is a four year Commonwealth-funded project working with more than 45 landholders to conserve, restore and better-manage over 4000ha of globally significant ecosystems in the Upper Coldstream catchment. The focus of the project is on environmental protection and restoration activities that include bushland regeneration, community education, training and awareness raising and vertebrate pest control. A major spin-off of the UCBP has been the establishment of the Coastal Emu Alliance, a group involving community and government stakeholders aimed at preventing the extinction of the Coastal Emu.

An important focus (and high priority for maintaining biodiversity across the project area) is the sustainable and appropriate management of fire across both private and public lands. The UCBP has recently partnered with the Hotspots Fire Project to successfully deliver the Pillar Valley Hotspots workshop series. It involved many participants of the project as well as many additional landowners, traditional owners and public land managers. The integration of Hotspots with the UCBP created significant project efficiencies and synergies and contributed to the development of consistent best-practice fire and biodiversity management actions across a much larger landscape than either project could have achieved individually. Other important outcomes arising from project integration have been the development of social cohesion and a community of good environmental management practice that did not previously exist. All these positive outcomes will need to be expanded if extinction of the Coastal Emu is to be avoided.

## Relative effects of fire on fauna in fragmented grazing landscapes

*Dr Teresa Eyre, Queensland Herbarium, Qld*

Almost 60% of the forest and woodland cover of the Brigalow Bioregion have been lost since European colonisation. Clearing has predominantly been focused in the productive areas for the purposes of grazing, creating a landscape mosaic of numerous small and isolated fragments of remnant vegetation interspersed with native and exotic pastureland. While there is a growing awareness of the importance of these fragments for biodiversity conservation, it is known that small fragments are susceptible to changed ecological processes that facilitate biodiversity homogenisation and decline.

However, little is known about the use and impact of prescribed burns as an ecological process in retained patches in these fragmented landscapes, particularly upon biodiversity values. In the region, fire is primarily used as a tool for the promotion of pasture growth through the removal of moribund grass material and the control of woody regrowth to reduce competition. However, fire is used inconsistently both spatially and temporally, as fuel loads are often only sufficient to sustain burning following a number of years of above-average rainfall, and there is a reticence by some - but not all - land managers to burn potential drought forage reserves. Here we address the question whether the use of fire has any discernible impact upon biodiversity values across a number of grazing properties in the Brigalow Bioregion, by examining the interactive effects of fire and habitat fragmentation on vertebrate assemblages.

## Overcoming critical ecological thresholds in fire-excluded ecosystems: Restoration of an endangered heathland in rapid transition to forest

*Andy Baker, Southern Cross University, NSW*

The encroachment of forest into fire-excluded heathland and grassland is a worldwide phenomenon. Increased shade under the encroaching forest canopy may ultimately cause the complete displacement of the original heathland/grassland flora and dependent fauna. While the reintroduction of fire is crucial to restoring these ecosystems, restoration may be complicated where encroaching trees have become resistant to removal by fire (fire-resistance threshold), or where the loss of the flammable ground layer prevents the spread of a low-intensity understorey fire (fire suppression threshold). This presentation discusses the use of fire to restore an endangered heathland in north-eastern NSW, of which c. 60% had been displaced by forest following 50 years of fire exclusion. Early ecological burns had limited success wherever the fire-resistance or fire-suppression thresholds had already been passed, prompting a revised restoration approach. We found that the solution to effectively using fire to restore encroached ecosystems is to remove or thin encroaching trees using herbicide or mechanical treatment at least one year before applying fire. Not only does this remove fire-resistant trees, but the increased sunlight stimulates regeneration of the flammable understorey crucial for carrying an ecological burn throughout the site.

The presentation demonstrates real world examples of fire-vegetation interactions, outlining the mechanisms and ecological consequences of forest encroachment following fire exclusion, and also overcoming critical thresholds to reintroducing fire as a restoration tool in fire-excluded vegetation. The findings are widely applicable to the conservation and restoration of all fire-dependent vegetation wherein canopy closure/thickening has suppressed the flammable ground layer following fire exclusion.

## Burning an endangered species: importance of understanding habitat dynamics for Northern Eastern Bristlebird conservation

*Zoë Stone (S), Associate Professor Martine Maron and Dr Elizabeth Tasker\*, The University of Queensland, Qld and the NSW Office of Environment and Heritage, NSW\**

The Northern population of the Eastern Bristlebird (*Dasyornis brachypterus*) (NEBB) occupies open grassy Eucalypt forest on the rainforest margin along the QLD/NSW border. This habitat is highly dynamic, and fire plays a key role in maintaining understorey grass condition and reducing shrub encroachment. Shrub encroachment and habitat degradation from inappropriate fire regimes remain the main threats to NEBB recovery. With such a small population size, and severe fragmentation between individuals, the risk of direct mortality and possible local extinction from fires is however, problematic. The question then arises of how the implementation of necessary fire management for habitat maintenance might affect conservation efforts of such a critically endangered species?

This presentation will discuss current research into the habitat dynamics of these grassy systems. In particular how NEBB persistence across the landscape has been influenced by various fire regimes. To do this, we collated a range of fire history information from various stakeholders across the known historical range of NEBB. This was then modelled against NEBB presence/absence records across historical territories to determine the influence of various fire regimes on their persistence. Local extinctions of some territories have resulted directly from large wildfires at some locations. NEBB presence was also significantly influenced the fire frequency, particularly prior to the 1990s.

In addition, local extinctions have occurred at sites which had fire too frequently (every year). At these sites, important tussock grasses for breeding are replaced, and habitat heterogeneity is reduced. Fire regimes with appropriate fire intervals (4-5 years) assist in maintaining a thick grassy and tussock dominated understorey, which are key structural requirements for NEBB. Understanding how NEBB respond to various fire regimes will assist in developing the best habitat management strategies, to increase habitat quality, promote breeding and reduce direct mortality risks.

## Theme 10

### Fires in the Past: Essential Knowledge for Management

#### Late Quaternary fire regimes of Moon Point, Fraser Island

*Philip Stewart (S) and Associate Professor Patrick Moss, University of Queensland, Qld*

Fire is an important driver in ecosystem evolution and is vital for maintaining the ecosystems of Fraser Island. Charcoal records for the area dating back over 40, 000 years (BP) provide evidence of the great changes in vegetation in the region over time as a result of a changing climate and fire. Preliminary results from the analysis of charcoal records show that Moon Point south has been subjected to changing fire regimes for over 23K with substantial variation in frequency and return intervals, which seem to correlate with the changing climate from a wet to dryer environment, resulting in vegetation shift from fire sensitive to fire prone and tolerant vegetation.

#### Satellite imagery interpretation of current and past fire history information in the Upper Maranoa area of southern inland Queensland

*Peter Thompson and Rhonda Toms-Morgan, Queensland Murray Darling Committee, Qld*

Federal investment for carbon abatement through enhanced biodiverse carbon stores has proven to be a catalyst to mobilise primary producers, public and private sector participation in fire planning in the Queensland Murray-Darling Basin.

The use of satellite imagery to monitor and map past fire activity is a widely used management tool throughout northern Australia. As a part of the "Landscape Fire Planning in Poplar Box Grassy Woodlands in the QMDB" project funded by the Australian Government, an analysis of Landsat imagery information is being used to look at the current and historic pattern of fire activity in an area of 300,000 hectares in the Upper Maranoa region 600 km west of Brisbane.

The study is utilising 29 years of Landsat imagery information published by DSITI to produce maps, reviewed with landowner records to gain a better understanding of the long term implications of both deliberate burning and wildfire activity in the study area. The long term absence of recorded fire activity over significant areas in this landscape over this time period will also be interrogated in key Regional Ecosystems. In a landscape that is showing encroachment and thickening of Cypress Pine communities in particular, better management of fire and grazing issues are seen as important factors for both conservation and productivity outcomes.

This information is being analysed in terms of fire frequency compilations of the available information to explore differences in management practice and to investigate the relationship between fire activity and seasonal rainfall variations in this region which is characterised by highly variable and unreliable seasonal rainfall patterns.

## The influence of time since last fire on the soil seedbank and woody understorey of temperate eucalypt forests

*Helen Vickers (S), Dr Craig Nitschke, Dr Thomas Duff and Dr Sabine Kasel, University of Melbourne, Vic*

Increased fire occurrence as a result of climate change & planned burning may alter the composition of temperate eucalypt forest understorey's & soil seedbanks (SSB) over time. We aim to explore the relationship between time since last fire (TSLF) & the composition of the SSB & woody understorey vegetation. 32 sites in damp & wet eucalypt dominated forests were sampled for SSB & understorey vegetation in south-eastern Australia in 2013/2014. Plots were located in areas that had most recently burnt in 2009, 1983 or 1939. Species richness (SR) of understorey vegetation was significantly greater than the SSB. SR of understorey vegetation declined with increasing TSLF while no clear trend in SR of the SSB could be identified. Similarity in species composition between understorey vegetation & the SSB was low across all fire years, with the proportion of shared species greatest in 1983. Wet forest showed significant differences in SSB species composition between 2009 & 1939 in addition to significant differences in number of germinants/m<sup>2</sup>. Several species in the understorey & SSB occurred across all fire years however varied in abundance. Our study suggests that increasing TSLF is important for the accumulation of species & propagules in the SSB of wet forests. Frequent fires (<30 years) would likely result in a decreases in species richness of the SSB & may lead to changes in understorey species composition & abundance.

## A late Quaternary fire history of the Kimberley region, northwest Australia: new records from the Northern Kimberley Bioregion

*Emily Field (S), Associate Professor Patrick Moss and Professor Hamish McGowan, University of Queensland, Qld*

Tropical northern Australia is comprised primarily of savanna where the vast majority of Australia's bushfires occur. Approximately half of the Kimberley's landscape is currently burnt each year predominantly by traditional Aboriginal owners, farmers and conservation managers (CSIRO, 2016). There is growing concern that disruption of traditional burning practices, alongside introduced grazing animals in the region has resulted in declining biodiversity and soil degradation. The mosaic of small fires used by the Indigenous population for hunting and other purposes has been replaced by extensive fires which now typically occur as more damaging "hot" fires during the late dry season (Government of Western Australia, 2011).

In order to gain an understanding of long term patterns in burning across the Kimberley, or a "baseline" against which current fire practices can be compared, microscopic charcoal preserved in organic spring sediments in the Northern Kimberley Bioregion can be used to reconstruct fire histories. Two such records will be presented on an approximately ~100km transect, with comparisons between the records able to elucidate whether changes in burning seen at each site is local or regional in extent. These continuous, high resolution records span most of the Holocene with both showing increases in fire activity within the last millennium possibly as a response to an increased local Aboriginal population and fire stick farming. Fossilised pollen and sedimentological evidence at both sites also provide a corresponding record of vegetation and environmental change which may help to disentangle anthropogenic vs. climatic drivers of these long term trends in burning.



## Fires in the past: An overview of late Quaternary burning patterns for eastern Australia

*Associate Professor Patrick Moss, University of Queensland, Qld*

There is a key debate about past fire regimes in the Australian for the late Quaternary period (i.e. last 50,000 to 60,000 years), which is related to agency (i.e. anthropogenic vs natural) and the resultant environmental impacts, particularly vegetation alterations and changes in burning patterns. This discussion has very important implications for contemporary and future fire management strategies, as past fire regimes have played a critical role in shaping the Australian landscape and it is crucial to gain an understanding of the relative influence that people and climate had on burning patterns for the last 60,000 years.

For instance is the Australian landscape an artefact of 10,000s years of anthropogenic fire regimes or does the underlying climate play the key role in shaping the environment over the late Quaternary period? This presentation will focus on late Quaternary pollen and charcoal records from three key sites across Australia, the Wet Tropics of northern Queensland, the giant sand islands of South East Queensland and Tasmania to provide understanding into the complex relationships between fire, climate and people, as well as giving insight into the relative impacts of humans and climate on these unique landscapes and potential management implications

## Poster Presentations

### **The Firesticks Project: Applying Aboriginal ecological knowledge and integrated weed, fire and pest management to maintain biodiversity, connectivity and landscape resilience**

**Ritchie Brittingham**

*Nature Conservation Council of NSW*

### **Economic evaluation of prescribed fire as a mitigation tool for bushfire risk in southeast Queensland**

**Martyn Elliott 1, Dr Tyron Venn 1, 2, Dr Sanjeev Srivastava 3, Dr Tom Lewis 4 and Andrew Sturgess 5**

*1 School of Business and Law, University of the Sunshine Coast; 2 Tropical Forests and People Research Centre and Forest Industries Research Centre, University of the Sunshine Coast; School of Science and Engineering, University of the Sunshine Coast; 4 Department of Agriculture and Fisheries, Queensland; 5 Queensland Fire and Emergency Services.*

### **Powerlink Queensland management of linear corridor wildlife barrier impacts in a high voltage electricity transmission context**

**Ben Kanowski**

*Powerlink Queensland*

### **Fire regimes and vegetation change in tropical northern Australia during the late-Holocene**

**Lydia MacKenzie 1, Associate Professor Patrick Moss 1, Professor Sean Ulm 2, Dr Craig Sloss 3, Professor Henk Heijnis 4 and Dr Geraldine Jacobsen 4**

*1 School of Geography, Planning and Environmental Management, University of Queensland; 2 James Cook University; 3 Queensland University of Technology; and 4 Australian Nuclear Science and Technology Organisation.*

### **Bushfire Fuel Classification**

**Chris Morton**

*Australasian Fire & Emergency Service Authorities Council*

## Poster Presentations

### **Holocene fire and vegetation history in the sub-alpine grasslands of Surrey Hills region of northern Tasmania**

**Associate Professor Patrick Moss, Dr Peter McIntosh\* and Emma Watson**

*School of Geography, Planning and Environmental Management, University of Queensland and Forest Practices Authority, Tasmania\**

### **Information Tools for Bushfire Mitigation Planning in Queensland**

**Robert Preston, Justin Leonard\*, James Haig and Rosalie Buck**

*Queensland Fire and Emergency Services and CSIRO\**

### **Facilitating a biodiversity legacy for the South Burnett region**

**Suanne Richards and Denise Whyte**

*South Burnett Regional Council*

### **National Burning Project**

**Deb Sparkes and Greg Esnouf**

*Australasian Fire & Emergency Service Authorities Council*

## Thank you to our Sponsors

### Gold Sponsors

#### Fireland

Fireland is a Queensland privately owned and operated company specialising in land and bushfire management. Our team of professionals have a passion and strong commitment to the environment and we assist communities in need. We strive to set the standard for land management, hazard assessment, fire management planning, prescribed burning and wildfire suppression. Fireland employ dedicated and highly skilled staff and provide the equipment, training and support to ensure every project is a success in reducing bushfire risk.



#### Healthy Waterways and Catchments

Not-for-profit organisations Healthy Waterways and SEQ Catchments have joined together to form a single leading-edge community-focused, natural resource management organisation, Healthy Waterways and Catchments. Healthy Waterways and Catchments is a community based, not for profit organisation helping to build a sustainable community that cares for and values the natural resources and biodiversity of South East Queensland. Healthy Waterways and Catchments is supporting Bushfire 2016 through funding from the Australian Government's National Landcare Programme.



#### University of Queensland

The University of Queensland is internationally recognised as having a strong and vibrant research culture and is currently ranked in the top 1% of world universities and in the top-three Australian institutions in the recently released Australian Research Council's Excellence in Research for Australia round, with particular strengths in the Environmental Sciences.

A key course in fire ecology and management is ENVM2512 Fire Management ([http://www.courses.uq.edu.au/student\\_section\\_loader.php?section=1&profileId=80733](http://www.courses.uq.edu.au/student_section_loader.php?section=1&profileId=80733)), which can be taken as an external online course and undertaken through the Bachelor of Environmental Management and Bachelor of Science degrees with plans to offer a postgraduate version in 2017.



## Silver Sponsors

### GHD

Founded in Australia in 1928, GHD is a professional services business, with a collaborative network of land management, ecology, bushfire and forestry professionals operating from more than 40 offices around Australia. We have a strong regional understanding and presence. We provide experienced and innovative inter-disciplinary teams to help you find practical, science-based solutions to your natural resource management challenges. We are very pleased to participate in the knowledge sharing of 'Bushfire 2016'.



### Queensland Fire and Emergency Services

QFES has a mission of creating safe and resilient communities by minimising the impact and consequences of emergencies on the people, property, environment and economy of Queensland. Working in partnership with the community, QFES plans for and mitigates against disasters aligning with community expectations around appropriate prevention, preparedness, response and recovery services.



### Terrestrial Ecosystem Research Network

TERN is delivering critical research infrastructure and supporting national and international networks of scientists, environmental managers and stakeholders. It connects ecosystem scientists and enables them to collect, contribute, store, share and integrate data across disciplines. Collectively this increases the capacity of the Australian ecosystem science community to advance science and contribute to effective management and sustainable use of our ecosystem



## Bronze Sponsors

### Ecological Society of Australia

The Ecological Society of Australia (ESA) is the peak group of ecologists in Australia with over 1500 members from all states and territories, and a 50-year history supporting ecologists, promoting ecology and ecological research. We aim to create a community of knowledge and understanding amongst ecologists, and reach out to those working in related fields.



### Bushfire and Natural Hazards Cooperative Research Centre

The Bushfire and Natural Hazards Cooperative Research Centre draws together all of Australia and New Zealand's fire and emergency service authorities, land management agencies, as well as non-government organisations and leading experts across a range of scientific fields to explore the causes, consequences and mitigation of natural disasters.



### Powerlink

Powerlink is the high voltage (HV) transmission provider in Queensland, stretching over 1,700km from the NSW border to Cairns with land maintenance programs including fire risk management with key stakeholders. Powerlink has been a long term supporter of SEQ Fire & Biodiversity Consortium and is a proud sponsor of Bushfire 2016.



### University of Melbourne

The School of Ecosystem and Forest Sciences at the University of Melbourne combines expertise in biological and physical sciences with environmental social science to enrich our teaching in the area of applied ecosystem science, making sure that it is relevant to society and contributes to the development of innovative solutions to environmental issues faced by a rapidly growing global community.



## Promotional, Trade and Satchel Insert Sponsors

### Australasian Fire & Emergency Service Authorities Council

AFAC is the Australian and New Zealand National Council for fire, emergency services and land management, creating synergies across the emergency management sector. Our members support mitigation and response phases of emergency management across multiple hazards and the transition to recovery.



### Boomerang Bags

Boomerang Bags works to reduce the use of plastic bags by engaging local communities in the making of Boomerang Bags – community made using recycled materials. Boomerang Bags provide a free, fun, sustainable alternative to plastic bags.



### CSIRO Publishing

CSIRO Publishing's international publishing programme covers a range of scientific disciplines, including agriculture, the plant and animal sciences, planning and building, health and environmental management. Our product range includes journals, books and magazines, in print and online.



### Horizon Unmanned Aerial System

Horizon's Yamaha RMAX Unmanned Aerial System incendiary unit provides for safer and more efficient hazard reduction burning and fire fighting operations.



### ICT International

ICT International have sensors and wireless systems that are widely used in research and land management. The sensors such as NDVI and Sap Flow are highly adaptable from traditional applications to fire research and prevention. The wireless systems are designed for use remote locations and low power applications.



### International Association of Wildland Fire

The International Association of Wildland Fire is a non-profit, professional association facilitating communication, providing leadership and representing members of the global wildland fire community.



### NRMjobs

NRMjobs is a niche service – communicating and promoting jobs and opportunities in the environment, water and natural resource management and targeted at people who work, study or are seeking work in the environment water and natural resource management field in Australia.



### Quik Corp Fire Engineering

QCFE offers unique innovative equipment and vehicles to the fire and emergency services industry. From hose reels to full vehicle back design, Quik Corp can customise any design suited to your requirements. The preferred supplier by fire agencies nationwide.



### Rural Fire Brigades Association Queensland

The Rural Fire Brigades Association Queensland (RFBAQ) is the association that represents the interests of all rural fire brigades in Queensland. RFBAQ is committed to ensuring that the wider community recognises the level of commitment, professionalism and service as well as the social and economic contribution made by the brigades and the volunteers.





## Useful Information

### Mobile Device Apps

#### Maps

“UQnav” is a new, free mobile application for iPhones that contains searchable maps of the University of Queensland’s campuses. Enter your destination and UQnav will show you where it’s located. Students, staff and visitors can use UQnav to help find lecture theatres, laboratories, school and faculty offices, as well as where to grab a coffee or have a bite to eat. For more information and to download the app go to: [www.uq.edu.au/uqnav/](http://www.uq.edu.au/uqnav/)

#### Transport

“MyTransLink” is an app that makes getting around Brisbane easy by providing easy access to bus, train, ferry and tram information. The app’s customisable features enable you to plan your journey and ensure you get the service updates. MyTransLink is available free from the App Store and Google Play. For more information and to download the app go to: [www.translink.com.au](http://www.translink.com.au)

#### Internet and Wifi Access

The primary wireless network available at UQ is “eduroam”. This is a secure international roaming service for users in Higher Education. A series of participating universities and other institutions around the world support and provide access to this network. Using eduroam at UQ enables staff and students to also access their internet and email as they travel both within and outside of Australia. Further information on this service can be found on the web at: [its.uq.edu.au/services/internet-and-wifi](http://its.uq.edu.au/services/internet-and-wifi)

If you are not part of the eduroam network you can still connect to the internet by going to the wifi settings on your device and choosing the “*visitor UQ connect network*”. If you require assistance contact ITS Client Services on 07 33656000 or visit the Prentice Building (Building no. 42) on campus.

#### Location and Venue

Bushfire 2016 is being held at the **University of Queensland’s (UQ), St Lucia campus**. The main entrance to UQ is located along Sir Fred Schonell Drive. St Lucia is located southwest of Brisbane, approximately 8km from the CBD, 7.5km from South Bank and 3.5km from Toowong. The Plenary sessions will be held in the *Abel Smith Lecture Theatre, Building 23* – see the map at the back of the program or map ref J7 on the accompanying UQ map, or go to <https://goo.gl/maps/u6FD3bFed8n> to navigate the UQ map.

#### Does the St Lucia campus allow for differing accessibility?

Yes. Visit the “Access Maps” page on the UQ website ([www.pf.uq.edu.au/maps/accessmaps.html](http://www.pf.uq.edu.au/maps/accessmaps.html)), or call Building Facilities on (07) 3365 9111. If you have any trouble finding the relevant information, or require our assistance, please let us know and we will help find the necessary information.

## Transport and Parking

### Getting there by car

The main entrance to the University is along Sir Fred Schonell Drive, located on Map 179 F2 of the UBD Brisbane "Refidex" Street Directory. From Brisbane's Central Business District, Sir Fred Schonell Drive is most easily accessed via Coronation Drive. Please visit the UQ Parking website ([www.uq.edu.au/parking](http://www.uq.edu.au/parking)) for information about visitor parking on campus. We recommend parking in car park 98C on Sir William MacGregor Drive.

### Getting there by ferry

The CityCat ferry is an enjoyable means of getting to the St Lucia campus, however, it can be slow and you may need to allow additional travel time. The campus CityCat terminal is located near the corner of Sir William MacGreggor Drive and Blair Drive. The Brisbane City Council provides a map of all CityCat stops ([www.brisbane.qld.gov.au/traffic-transport/public-transport/citycat-ferry-services/citycat-ferry-terminal-locations](http://www.brisbane.qld.gov.au/traffic-transport/public-transport/citycat-ferry-services/citycat-ferry-terminal-locations)).

For timetables and further information, try the TransLink Website (<https://translink.com.au>) or call TransLink on 13 12 30.

### Getting there by bus

There are two bus stations located at UQ – the Chancellor's Place bus station and the UQ Lakes bus station. The Chancellor's Place bus stop is located near the J.D. Story Building, Building 61 (map reference G9 on the official UQ map) and the UQ Lakes bus stop is located near Field No.3 and the Alumni teaching garden. For timetables and further information, try the TransLink Website (<https://translink.com.au>) or call TransLink on 13 12 30.

From Brisbane's Central Business District, the Brisbane City Council (BCC) bus routes that run directly to UQ are:

- 412 (express from City to Chancellor's place station),
- 411 (City to Chancellor's Place), and
- 109 (City to UQ Lakes).

Other main BCC bus routes that stop at UQ are

- 66 (South Bank Busway Station, platform 2, to UQ Lakes),
- 402 (Toowong to Chancellor's Place),
- 428 (Indooroopilly to Chancellor's Place),
- 427 (Chapel Hill to Chancellor's Place),
- 414 (West Taringa to Chancellor's Place),
- 209 (Carindale Interchange to UQ Lakes) and
- 169 (Eight Mile Plains busway to UQ Lakes).

### Getting there by train

The nearest train station to the St Lucia campus is Toowong, on the Ipswich train line. From Toowong Station, cross Benson Street and catch a bus to UQ - the 402, 411, or 412. Alternatively, the Dutton Park stop, on the Beenleigh/Ferny Grove train line, is situated near the Eleanor Schonell Bridge.

It is possible to walk from Dutton Park Station, over the Eleanor Schonell Bridge to the St Lucia campus – this is approximately 2km (allow for 30 minutes). You can also catch the Beenleigh/Ferny Grove, Shorncliffe/Cleveland, or Airport/Gold Coast lines to Park Road Train Station and walk over the overpass to the Boggo Road Busway to catch the 66, 29, 139, 169, or 209 bus to UQ Lakes. For timetables and further information, try the TransLink Website (<https://translink.com.au>) or call TransLink on 13 12 30.

### Getting there by bicycle

The St Lucia campus is easily accessed by bicycle, with a safe riverside bicycle path connecting the St Lucia Campus to the city as well as via the Eleanor Schonell Bridge. Find out about bicycle travel to UQ from the Cycling at UQ website (<https://www.pf.uq.edu.au/cycling/>). Bike parking facilities are available.

### Accommodation

The St Lucia campus is located southwest of Brisbane, approximately 8km from the CBD, 7.5km from South Bank/West End and 3.5km from Toowong – these being the best spots to stay. The *Visit Brisbane* website has comprehensive information on Brisbane, including accommodation. The *Airbnb* and *Stayz* websites also provide many accommodation options.

### Where can I get a coffee?

We will have coffee and a variety of tea available during breaks, but there are several places to get a good coffee (or tea) on campus:

- Bar Merlo – Duhig Building facing the Great Court, open from 7am;
- The Deck – in the UQ Sport and Fitness Centre, open from 7am; and
- Wordsmith Café, open from 7am.

Notes

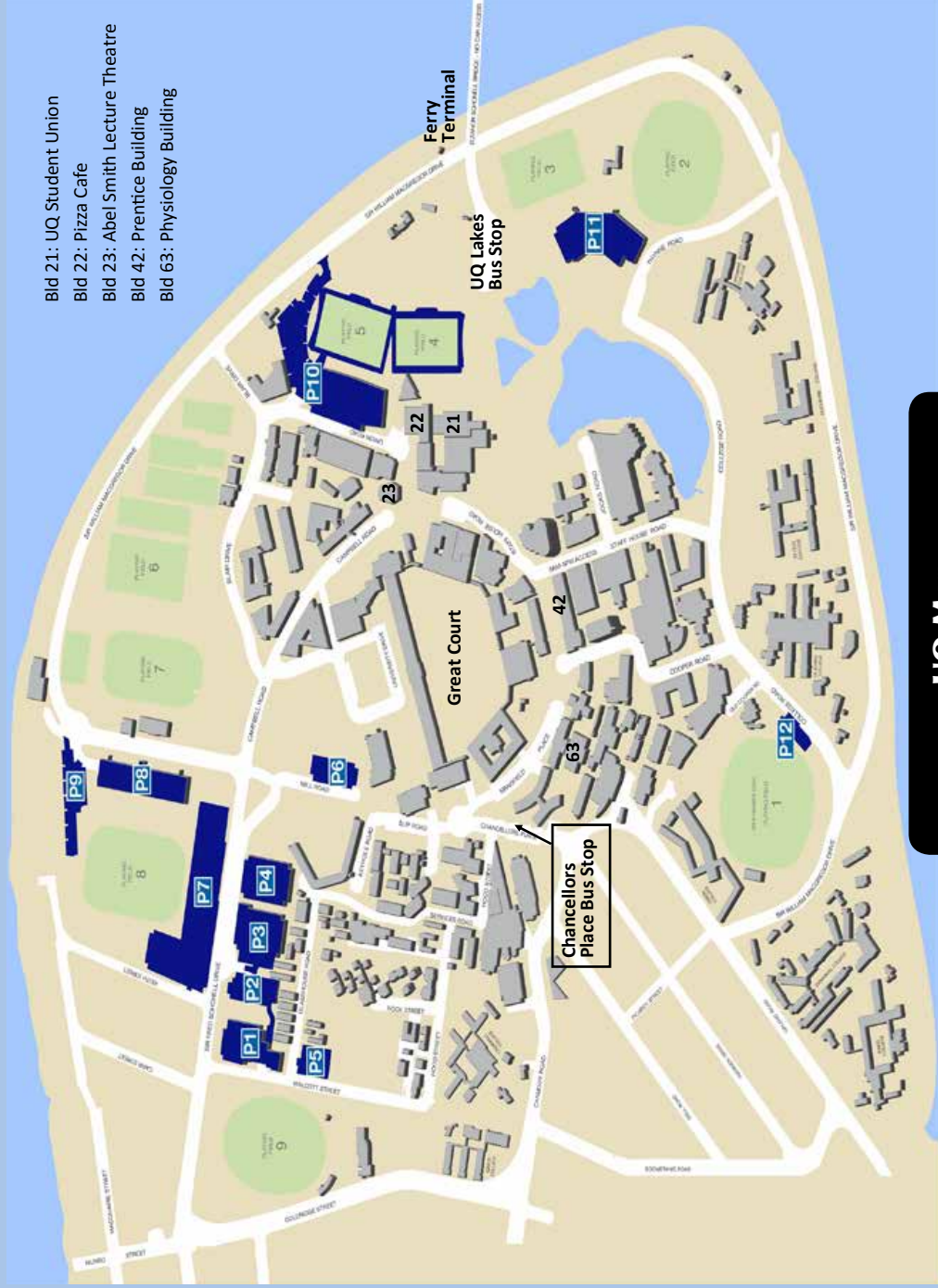
## Notes



Notes

## Notes

- Bld 21: UQ Student Union
- Bld 22: Pizza Cafe
- Bld 23: Abel Smith Lecture Theatre
- Bld 42: Prentice Building
- Bld 63: Physiology Building





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BUSHFIRE 2016



[www.fireandbiodiversity.org](http://www.fireandbiodiversity.org)

