



## Fire, Frogs and Orchids

### The Focus on North Stradbroke Island

Over 116 people converged on North Stradbroke Island, on March 26, for the tenth biannual fire forum hosted and coordinated by the South East Queensland (SEQ) Fire and Biodiversity Consortium. Delegates were treated to a special Welcome to Country by Quandamooka Elder Auntie Joan Hendriks. The forum focused on new and emerging fire science as well as fire research currently being conducted on the Island and the aftermath of the January 2014 bushfire.

The forum hosted a range of speakers, including Dr David McKenna (Department of Environment, Water and Natural Resources, South Australia) who spoke about managing fire and risk in a fragmented, multi-tenure landscape; Dr Mark Ooi (University of Wollongong, New South Wales) who spoke about seed dormancy and the role of fire (i.e. heat and smoke) in triggering seed germination in many east coast heathland plant species; Dr Katrin Lowe (recent Griffith University PhD graduate) who spoke about 'acid frogs' (i.e. frogs that can tolerate the acidic waters of eastern Australia's coastal wallum swamps and wet heathlands) and resilience to wildfire; Laura Simmons (PhD Candidate, University of the Sunshine Coast) who spoke about the effects of fire on the endangered orchid *Phaius australis*; and Graeme Martin (Station Officer Queensland Fire and Emergency Services) who presented on the January 2014 Stradbroke Island fire and associated responses.

Delegates spent the afternoon on one of two field trips in the 'Blue Lake' section of Naree Budjong National Park, with Kathy Stephens (author of "Flora of North Stradbroke"), Michael Nothling (Queensland Parks and Wildlife Services Ranger), Darren Burns (Joint Management Coordinator of the Quandamooka Yoolooburrabee Aboriginal Corporation and QPWS Senior Ranger) and Greg Litherland (retired Forester) providing insight into flora and fire management on the Island.

*"As a member of the SEQFBC Education Working Group I was really thrilled with the support and interest we received for the forum. The speakers were formative and engaging, providing fascinating examples of how Australian flora and fauna live with fire, with particular emphasis on examples from Stradbroke Island"* Said Maree Manby Redlands City Council.

By Sam Lloyd, SEQ Fire and Biodiversity Consortium Coordinator.

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**Cover photo:** Participants of the South East Queensland Fire and Biodiversity Consortiums Forum on Stradbroke Island March 2015, during a field trip into Naree Budjong Djara National Park, Stradbroke Island.

# Editorial

Welcome to the first edition for the year.

Sam and I have managed to alternate additions to our families, with Sam taking maternity leave for the majority of 2014 to look after their beautiful daughter Georgia, and I took off on paternity leave for the month of May this year with the birth of my beautiful daughter Pippa.

We were fortunate to have Dr Mark Schuster take on one day a week while Sam was away. Mark took on the role of keeping you all up-to-date with the E-news articles, wrote a draft chapter for the RFSQ Fire Warden Manual on the use of fire in the landscape, and presented many talks and one workshop. It was a pleasure to have you in the office Mark. Mark will be assisting us by facilitating of a new workshop program (written by Mark) for local councils on fire management planning.

This newsletter highlights the work we have achieved since November 2014, the benefits of SEQFBC coordinated fire management planning workshops for bushfire mitigation, a response to an article by Tng *et al* (2014) about prescribed burning in the tropics, our popular overall fuel hazard training, the Queensland Audit Office report on Queensland's preparedness for bushfires, our recent scholarship recipients, and a review on UQ researcher Emma Burgess' recent paper on variable fire regimes in the Carnarvon Station Reserve. I hope that you enjoy reading the newsletter. We welcome any feedback.

Kind Regards

**Craig Welden**

SEQ Fire and Biodiversity Coordinator

## Who are we?

Established in 1998, the South East Queensland Fire and Biodiversity Consortium (SEQFBC) is a network of land managers and stakeholders devoted to providing a coordinated response and best-practice recommendations for fire management, fire ecology and the conservation of biodiversity in the South East Queensland (SEQ) region through education, community engagement and applied research.

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Please note:

Craig currently works Tuesday through to Friday.

# Thanks Noel!

By Sam Lloyd



On Friday the 27th of March Noel Ainsworth finished in his role as Performance Manager with SEQ Catchments (SEQC). As part of the responsibilities of this role, Noel was Manager to Craig and I, oversaw the financial planning of the SEQFBC and acted as the SEQC representative on the SEQFBC Steering Committee. Noel was an integral part of the team that helped secure SEQC as the host for the SEQFBC in 2010, and again provided sound advice and support when we sought to extend the hosting arrangements for a further 3 years in 2013. Noel has been a tremendous source of support, advice, professionalism and integrity for me, Craig and the SEQFBC over the past 5 years. Certainly, the SEQFBC (and SEQC) are losing in his departure and Craig and I wanted to take this opportunity to recognise his significant efforts and contribution to the SEQFBC and say a huge thank you.

The Chair of our Steering Committee, Chandra Wood, also recognised Noel's contribution to the SEQFBC, *"my thanks to you for your steadfast support and encouragement of the Consortium over the last five years... We will miss your sage advice and wisdom on so many different levels. It has been a pleasure to work with such a professional operator as yourself."*

We wish you the very best in your future endeavours and hope that our paths cross again.

# Upcoming Events

By Craig Welden

## 5th International Conference of Fire Effects on Soil Properties

**Date:** 14-17 July 2015

**Location:** Dublin, Ireland

The conference aims to bring together worldwide fire and soil researchers and contribute to scientific communication in the discipline. More information: <http://www.ucd.ie/ecomodel/fesp5/register.html>

## 6th International Wildland Fire Conference

**Date:** 12-16 October 2015

**Location:** Pyeongchang, Gangwon, Republic of Korea

Fire of the past, Fire in future

- Global natural and cultural fire heritage
- Protecting the global natural and cultural heritage from fire
- Towards a cohesive global fire management strategy

To Register: [http://en.wildfire2015.kr/page/content/conference\\_registration](http://en.wildfire2015.kr/page/content/conference_registration)

## ESA 2015 Annual Conference

**Date:** 29 November - 3rd December 2015

**Location:** Adelaide, South Australia

ESA 2015 is an opportunity to engage with some of the world's leading ecologists, and enjoy the biodiversity of South Australian ecology. The conference will feature symposia on regionally relevant issues such as arid, woodland and restoration ecology, interactions between aquatic and terrestrial habitats, the ecology of northern development, Indigenous knowledge and data management in the 21st century. It will cover the full range of biomes, from deserts to oceans, and embrace all aspects of ecological theory and practice. To find out more: ESA Annual Conference 2015



# Runs on the board

## Snapshot of what we have achieved since November 2014

By Craig Welden

Since our last newsletter in November 2014 we have had a very busy time of it and as you will read below and throughout our newsletter we would not have been able to achieve what we have without the support by SEQFBC's working groups in helping to spread the message of improved fire management and biodiversity conservation throughout SE Queensland.

Our popular Overall Hazard Fuel Hazard Training attracted 111 people in May this year and allowed greater access to our training, by providing two locations, Brisbane and the Sunshine Coast. (see training article). We have also been able to reserve spots for SEQFBC sponsors for the Fire Weather 1 and Fire Weather 2 training again this year. Thanks go to the Rural Fire Service Queensland Predictive Services team for organising this training.

Since our last newsletter we have delivered eight Workshops and talks attended by over 270 people. The workshops in the Moreton Bay Regional Council area have proved so popular that we now have waiting lists and as a result we are scheduling more workshops for this region in the latter half of this year.

We have again continued our Scholarship program to the value of \$3,000, with the generous support of Fireland Consultancy. This year we are pleased to announce that we awarded it to Martyn Elliott of the University of the Sunshine Coast for his Honours research (see page 5).

Since 2011, we have delivered over 126 E-news bulletins to up to 650 people currently on our distribution list. The online email marketing program Mail Chimp is now our preferred platform (free for us), which has proved to be more efficient and provides us with great analytics. Some of the comments about our E-news: *"keep up the good work on putting these E-news emails together. I often find something unexpected and interesting in these."* (Academic) *As usual you distribute the most relevant document associated with bushfires in Queensland. (NGO), Many thanks for your information updates throughout the year; always helpful and timely"* (Consultant).

It's great having Sam back and we are busy fitting in the coordination of a workshop for AFAC encompassing the region of southern Qld/northern NSW (i.e. subtropics) relating to two of the sub-projects under the National Burning Project to cover a suite of risks relating to risk to ecological values and operational activities due to prescribed burning.

This is but a snapshot of what have been up to, please check out the full picture in our annual reports available on our website - [www.fireandbiodiversity.org.au/steering.html](http://www.fireandbiodiversity.org.au/steering.html).



**Photo:** Dr Mark Schuster facilitating discussion in SEQFBC's Bushfire Planning Workshop for Brisbane City Council in May 2015. Dr Schuster facilitated the workshop on behalf of SEQFBC.



**Photo:** Co-author of the Overall Fuel Hazard Assessment Guide, Francis Hines providing training to Rural Fire Service Queensland Volunteers, council staff, consultants and QPWS staff at SE Queensland Fire and Biodiversity Consortiums Coordinated Overall Fuel Hazard Assessment Training at the Doonan Rural Fire Brigade Station, Sunshine Coast in May 2015. Photo Credit Sam Lloyd

## Overall fuel hazard training 2015

By Craig Welden

Training was provided for our partners on the application of the "Overall Fuel Hazard Assessment Guide" (4th edition) by Francis Hines of the Department of Sustainability and Environment Victoria and Tim Killen, State Wide Fire Trainer from Queensland Parks and Wildlife Services. Francis and Tim provided a very engaging one day training session repeated over 5 days for 113 participants. Some of the comments have included – *"The training was great – I enjoyed the day and learnt heaps"* and *"Awesome, credible presenters; Excellent presenter / venue / content; The content was exactly what I was after and what I expected; Way the course was delivered was excellent; was good given the time frames, not too theory laden; Excellent presentation skills; established a great rapport with the audience; Gave a good introduction and background to the concepts in the course and delivered the concepts in a way that was interesting and understandable; Changed my thinking of fuel loads and calculating; I had a basic understanding of the content and the training reinforced and expanded my understanding; Overall the course was excellent to participate in and highly recommend it to anyone involved with Wildfire management"*.

This training is in line with national recommendations for nationwide consistency in assessing fuel loads. As the guide is subjective, providing consistency with trainers will go towards a consistent approach to assessing fuels across the state.

# Assisting landholders in planning for bushfire risk with biodiversity considerations.

By Craig Welden

One of the key functions of the SEQ Fire and Biodiversity Consortium (SEQFBC) is to engage with private landholders to help improve their capacity to undertake fire management activities and preparedness on their property. As such, two of the primary issues that we constantly face with regards to private landholders (and Government agencies) - are prevention and preparedness - the first two elements of the Prevention, Preparedness, Response and Recovery model. Government agencies and society within Australia are very good at response and recovery, but there is much more work to do across the landscapes of SEQ with regards to prevention and preparedness for private landholders. This is especially true with respect to understanding landholders capacity to carry out prevention measures (namely hazard mitigation for bushfire), identifying the skills/knowledge gap and improving capacity.

Approximately 93% of land within Queensland is in private ownership (including freehold land, crown leasehold and aboriginal land) with the remaining 7% of the land under government administration (forestry reserve, nature conservation reserve, defence land, mining reserve and vacant crown land) (Geoscience Australia, 1993). This is where the SEQFBC Coordinated Fire Management Planning Workshops step in to assist landholders with understanding that preventative and preparedness measures can have impacts on "whole of landscape" bushfire mitigation as well as reducing the risk of wildfire on their property. Moreover, the workshops assist landholders in their understanding of the use of fire to positively maintain plant communities and assist in biodiversity conservation both at the local and landscape scale. This has impacts not only for biodiversity conservation, but also for agriculture, grazing and of course the safety of life and protection of property.

For most landholders fire is but one element in land management. Land managers must consider other time competing, but often complimentary elements, including weed management and pest animals. It has been recognized that fire management workshops that integrate "whole of land management" strategies, such as fire and weeds, improves outcomes for land managers and also assists with bushfire risk reduction strategies (evaluation of the NSW Hotspots Program 2014, courtesy of the Rural Fire Service NSW). Moreover, programs that incorporate fire management into whole of land management extension programs, such as the SEQ Fire and Biodiversity Consortium fire management planning workshops, assist in hazard identification and bushfire mitigation planning across the SEQ region.

These workshops are facilitated by SEQFBC, in partnership with the Rural Fire Service Queensland Officers, local government and other agencies as required, such as Powerlink Queensland and Queensland Parks and Wildlife Service. The workshops would not be possible without the great assistance of local government employees, RFSQ staff, SEQ Catchments staff and local RFSQ brigades and of course the wonderful RFSQ Voluntary Community Educators.

Participants have provided encouraging words about the program including: "essential for anyone living on acreage"; *Last Saturdays Fire Management workshop was great. As a landholder, rural firefighter, Volunteer Community Educator and Land For Wildlife member I highly recommend these workshops for anyone living in or near bushland.*

Since our last newsletter we have conducted over eight talks and workshops to over 270 people across SE Queensland. The workshops have proved so popular in one area (Moreton Bay Region), that we now have waiting lists and as a result we are scheduling more workshops for this region in the latter half of this year. Part of the success within the Moreton Bay Regional Council area is due to the work from Queensland Fire and Emergency Services/Public Safety Business Agency media officer Stella Lonzar, RFSQ Acting Bushfire Safety Officer Liane Henderson, the wonderful staff from Moreton Bay Regional Council Zoe Samson, Bruce Bunkum and Ainslie Wyer, the RFSQ Brigade volunteers where we typically hold the workshops and of course the RFSQ Community Volunteers such as Jan Blok and Nadine Anderson. If you'd like to see a workshop in your area please get in contact with us.



**Photo:** Rural Fire Service Queensland Voluntary Community Educator Jan Blok and Craig Welden SEQFBC providing landholders with guidance on how to create a fire management plan for their properties at Closeburn Rural Fire Brigade in February 2015. Photo Nadine Anderson RFSQ Voluntary Community Educator.



## University of the Sunshine Coast is Home to Fire Research Scholarship Two Years Running

By Sam Lloyd

For the second year running, a student from the University of the Sunshine Coast has been awarded the South East Queensland Fire and Biodiversity Consortium's (SEQFBC) Research Student Scholarship to undertake ground breaking fire research.

Successful recipient, Martyn Elliott, from the Faculty of Science, Health, Education and Engineering, from the University of the Sunshine Coast will undertake his Honours research into whether cerambycid beetles could be a useful bioindicator of environmental change associated with differing fire regimes. Specifically, Martyn hopes to establish a link between fire affected habitat, forest health and the composition of cerambycid beetles.

The scholarship assessment team were again challenged by the high calibre of applications from students undertaking valuable and cutting edge fire research. However Martyn's application stood out as potentially providing very useful information on vegetation health and fire management.

I am thrilled with the project we are supporting this year and believe Martyn will follow in the success of last year's scholarship recipients.

Honours is a tough year, but Martyn shows the academic ability and determination required to successfully complete his project and I am sure the outcomes will be of relevance and practical use to fire ecologists and fire managers in South East Queensland.

The Student Scholarship Program is funded and administered by the SEQFBC. It provides financial assistance and research



**Photo:** Successful recipient of the South East Queensland Fire and Biodiversity Consortium's Research Student Scholarship 2015, Martyn Elliott, the University of the Sunshine Coast receiving his award from Dr Sam Lloyd, Manager SEQFBC.

support to an honours, masters or PhD student undertaking research into applied fire ecology or fire management in the south east Queensland bioregion. Last year's scholarship recipients, Ross Walker and Brett Parker, were both awarded First Class Honours and have provided the SEQFBC membership with informative research outcomes.

The SEQFBC would like to acknowledge the kind philanthropic donation from Fireland Consultancy towards the scholarship for the second year in a row. Communication to the Consortium's stakeholders will be delivered through various avenues throughout 2015 - 2016.

For further information on the successful projects, the scholarship program or on the SEQFBC, please visit: [www.fireandbiodiversity.org.au](http://www.fireandbiodiversity.org.au).



## Comment on the Tng *et al.* 2014 paper referred to in the 18 December 2014, SE Queensland Fire and Biodiversity Consortium's E-News.

By Peter Stanton, John Kanowski and Paul Williams

We are writing in regard to a recent opinion piece, referred to in the 18 December 2014 SE Queensland Fire and Biodiversity Consortium's (SEQFBC) *E-News* called (*Burning giants in the tropics - will prescribed burning of giant eucalypt forests really help their regeneration?*), a 'hot topic' on the Ecological Society of Australia's website (<http://www.ecolsoc.org.au/hot-topics/>

burning-giants-tropics), by Tng *et al.* 2014. We are concerned because they seem to promote a "do-nothing" approach to tall eucalypt forest fire management in northern Australia, relying on infrequent, catastrophic fires to reset the ecosystem.

Tng *et al.* (2014) base this opinion on their assertion that *Eucalyptus grandis* is killed by canopy-scorching fire and entirely reliant on seedlings that mainly recruit after intense fires. However, *E. grandis* epicormically resprouts after canopy scorching fires. Seedlings of *E. grandis* recruit after fire of low and moderate intensities, not just high intensity fire. Young seedlings of *E. grandis* can survive low to moderate intensity fire, via coppice shoots, such that seedlings and saplings can persist in repeatedly burnt areas.

Tng's *et al.* (2014) recommendation to rely on occasional catastrophic fires to reset the ecosystem to a eucalypt forest, is dangerous to people, ignores the conservation significance of grassy tall eucalypt forests and is not supported by field observations.

Most rainforest pioneers can survive repeated fires via sub-soil basal coppice shoots, rapidly recover height to suppress grass cover and initiate further rainforest plant recruitment. We contend that managers need to deliberately burn grassy tall eucalypt forests, including in south-east Queensland, targeting sites where the eucalypts and grasses can be most easily be regenerated.

**Photo:** Epicormic resprouting of *Eucalyptus grandis* after intense fire, Coane Range, north-west of Townsville.

# Where the red meets the green

Excerpt from *(Balancing fire risk and biodiversity in fragmented landscapes using a comparison of interstate programs. Where Red Meets Green)*

STEVENSON, I., ANDREWS, L., WOUTERS, M., WELDEN, C., GRIEVE, B. & GOODING, O. 2014.

*Balancing fire risk and biodiversity in an urbanising landscape using a comparison of interstate programs. Where red meets green AFAC 2014. Wellington, New Zealand: AFAC*

All Australian states and territories face the challenge of finding solutions to managing risks to life and property as well as natural ecosystem changes caused by an increasing population in high bushfire risk areas. However, encouraging communities to take an active role in bushfire planning and management is challenging in communities where people do not have the experience of the risk posed by bushfires nor vegetation management methods to reduce risk.

With an increase in the use of planned burning comes the need to consider ecological outcomes. The capacity of fire agencies to do this on their own is limited so community engagement and partnership with natural resource management (NRM) bodies and land owners is crucial.

Queensland, New South Wales, Victoria, Tasmania and South Australia have all developed or are in the process of developing programs to meet this need. As a consequence of the similarities in these state based programs, the Interstate

Fire Alliance was formed to share the lessons of landowner engagement in fire management to produce a more unified approach to addressing the problem.

This paper discusses the lessons learned and the progress so far of several programs aimed at bringing together the fire agencies, land management agencies and land owners using innovative community engagement models.

**For more information on each of the state programs other than SEQFBC:**

NSW - <http://hotspotsfireproject.org.au/>;

VIC - <http://www.cfa.vic.gov.au/about/sustainable-fire-management/>;

TAS - <http://www.macquariefranklin.com.au/red-hot-tips.html>



**Photo:** The South East Queensland Fire and Biodiversity Consortium actively encourages landholders to consider the importance of fire in the landscape and the affects not just on life and property but to biodiversity conservation. SEQFBC, SEQ Catchments and Emu Creek Landcare Workshop on the Use of Fire and Landscape. Credit Craig Welden

## Queensland bushfire prevention and preparedness - Queensland Audit Office Report

By Craig Welden

The Queensland Audit Office commissioned a reporting on the effectiveness of Queensland's response to bushfire prevention and preparedness following recommendations of the 2009 Victorian Bushfires Rural Commission, the Malone Review into Rural Fire Services in Queensland 2013 (the Malone Review) and the Police and Community Safety Review (known as the Keelty Review).

Out of the above review recommendations that relate to community safety 114 out of the 168 recommendations have been implemented and it was recognised that Queensland is better prepared than before the 2009 review. However, the Audit report did identify some room for improvement for both Queensland Fire and Emergency Services (QFES) and the Public Safety Business Agency (PSBA).

The SEQFBC is encouraged by the top recommendation in "coordinating land managers efforts to assess and mitigate bushfire risk", along with four other recommendations that relate to reducing bushfire risk including the formalisation of the fire management groups, implementing an arson strategy, and working with local government to develop communication plans for communities in high bushfire risk areas.

You can download a copy of the report here:  
<https://www.qao.qld.gov.au/report-10-:-2014-15>

## SEQ Fire Weather Data Analysis

By Laura Gannon

How fire weather in SEQ is prescribed in planning and building instruments has remained a controversial matter for some years, particularly with regard to that adopted by "AS3959-2009 - Construction of Buildings in Bushfire Prone Areas." Data analysis was recently undertaken utilising daily fire weather data over 37 years from June 1972 to December 2009 for the Brisbane Weather District. The outcome of this analysis sought to identify annual return periods for significant fire weather events and reveals a 1 in 50 year Forest Fire Danger Index of 79 and a 1 in 100 year FFDI of 85. This remains substantially higher than the FFDI of 40 as currently adopted by the standard (AS3959) and indicates current planning and building provisions require further examination.

Generalised extreme value analysis was utilised to inform this research, which is focused on how FFDI is utilised and rationalised via planning and building instruments. It is noted the new "Methodology for Bushfire Prone Area Mapping in Queensland" (used to derive the current State Planning Policy mapping) identifies fire weather patterns across the State based on a 1 in 20 year event, which remains circa 60 in SEQ.

This research has demonstrated that an FFDI of 40 occurred more than 37 times during the analysis period, indicating the current Standard adopts an annual return period of less than a 1 in 1 year event in some areas of Queensland. Further research and dialogue is currently being undertaken with regard to identifying that which represents an appropriate annual return period for bushfire hazard planning in Queensland.

Laura is a senior town planner and bushfire planning specialist with Jensen Bowers Group. This analysis was undertaken as part of research informing a Masters in Bushfire Protection which Laura is currently studying with the University of Western Sydney.



# Bushfire Conference 2015

## Proceedings 10th Biennial Bushfire Conference, 2015 - Now available.

Source: Nature Conservation Council of NSW and Rural Fire Service News South Wales.

By Sam Lloyd

Once again the NSW Nature conservation council pulled together a terrific group of speakers and poster presentations, including a large number of indigenous projects resulting in an engaging and informative conference. Presentations drew on the experience and expertise of speakers from a broad range of areas including from science, Indigenous cultural values, on-ground restoration and management, with case studies exploring the innovations, challenges and outcomes of this work.

Transcripts and the slides of the presentations are available **free for download**.

Some of the presentations include:

Supporting and communicating applied subtropical fire research, Dr Samantha Lloyd (South-East Queensland Fire & Biodiversity Consortium) – a transcript of the presentation is available on [www.fireandbiodiversity.org.au](http://www.fireandbiodiversity.org.au)

Managing fire for nature conservation in sub-tropical woodlands, Emma Burgess (University of Queensland)

Combining science and fire to restore the habitat of a rare bird: a case study from north-eastern NSW, Dr Elizabeth Tasker (NSW Office of Environment & Heritage)



**Photo:** Opening Address of the Nature Conservation Council of NSW 10th Biennial Bushfire Conference Fire and Restoration, by Assistant Commissioner Stuart Midgley (NSW Rural Fire Service). Assistant Commissioner Midgley spoke of breaking down the boundaries in collaboration in restoration and of the many ground breaking projects the NSW RFS are involved with.

Navigating terminology: When is fire a tool for 'maintaining' vs 'restoring' ecosystems?,  
Dr Tein McDonald (Tein McDonald & Associates)

Setting the scene: climate change and the changing fire risk, Professor Lesley Hughes  
(Macquarie University, Climate Council of Australia)

The management of restored grassy ground cover sites: Fire as a tool in maintaining diversity and influencing vegetation structure, Dr Paul Gibson-Roy  
(Greening Australia)

There are 34 presentations and transcripts available free to download.

Read more: <http://www.nature.org.au/healthy-ecosystems/bushfire-program/conferences/>

A full report by Sam will be available on our website soon.

## Reviews

**Burgess, E. E, Moss, P., Haseler, M. and Maron, M. (2015) The influence of a variable fire regime on woodland structure and composition. International Journal of Wildland Fire. Vol 24, 59 – 69.**

By Sam Lloyd

### Introduction

PhD candidate Emma Burgess has written this paper with her supervisors from Bush Heritage Australia, Murray Haseler and the University of Queensland, Patrick Moss and Martine Maron. It's fantastic to see such promising student led research come out of southern Queensland. The authors recognise that post-fire vegetation responses are the result of the cumulative impacts of previous fires (i.e. fire interval, intensity, season), not just the most recent fire event, along with other biotic and abiotic factors (i.e. post-fire climatic conditions). Effective ecological fire management requires a better understanding of the relationship between variation in fire regimes and vegetation structure. However, there is a gap in our understanding of the response of vegetation to spatial and temporal variation in fire history. Emma and her team used 12 years of fire data to investigate how different combinations of time since fire, fire frequency and season of last burn affect stand structure and composition. Specifically, they examined

*"(1) how plants belonging to different plant life history categories are influenced; and (2) which life history categories contribute to the differences in vegetation structure and composition among different fire regime categories."*

### Methods

The study was conducted in Bush Heritage Australia's (BHA) Carnarvon Station Reserve, in the Carnarvon Ranges, Queensland. The dominant vegetation type is open eucalypt woodland. BHA have implemented a mosaic burning approach since 2001 involving small fires ignited throughout the year. The planned fire regime interval for the grassy eucalypt woodlands is 4–5 years. The spatial fire history of the reserve was mapped using Landsat MSS satellite imagery and ground truthing. The variation in fire history was classified into nine fire history categories (FHCs) based on frequency, season of burn and time since last fire. Early dry season relates to February to June and late dry season relates to July to October.

Detailed vegetation surveys were undertaken and woody plant species were allocated to one of four height classes (understorey 0–1m; shrub 1–2m; mid-storey 2–6m and canopy >6m for a total of 50 sites). Total species richness for each site was aggregated across the three subplots. Species were also divided into three life-history categories: canopy trees (>6m); mid-storey trees (<6m) and shrubs/sub-shrubs (shrubs rarely exceeding 2m).

# Reviews continued...

## Results

A significant response to FHC was detected for the mean abundance of woody stems ( $P < 0.01$ ) and total species richness ( $P < 0.01$ ). The mean abundance and richness of species in height classes 1-2m ( $P < 0.05$ ) and 2-6m (Abundance =  $P < 0.001$ ; Richness =  $P < 0.05$ ) were significantly different across FHCs. Mean abundance for mid-storey trees ( $P < 0.001$ ) and seeders ( $P < 0.05$ ) and richness for mid-storey trees ( $P < 0.01$ ) and canopy trees ( $P < 0.05$ ) were significantly different across FHCs. Significant differences were found between sites with a fire history of less frequent fires, with a long time since last fire and those burnt frequently with a short time since fire (all  $P < 0.05$ ). Sites with infrequent fire and last burnt in the early dry season (i.e. February to June and expected to be less intense when compared with late dry season fires) had greater species evenness (i.e. a measure of diversity based on how close the total numbers of each species are). The mean abundance of shrubs was significantly influenced by interactions between FHC and vegetation type ( $P < 0.05$ ).

## Discussion

Overall, the authors found that FHC strongly influenced species richness and abundance of mid-storey trees and shrubs. A longer time since fire ( $>4$  years since last burn), combined with infrequent fires ( $<2$  fires in 12 year period) appeared to promote a dense mid-storey, with the opposite conditions ( $<4$  years since last burn;  $>2$  fires in 12 year period) promoting more open woodlands. Therefore, simplification (decrease in species abundance or diversity) of woodland structure could result from a short time since last fire or too frequent fires.

**Fire regimes and habitat structure:** The authors found greater species richness and abundance of stems (0-1m, 1-2m and 2-6m height classes) associated with less frequent fires, burnt in the early dry season and with a longer time since last fire. Moreover, sites with frequent burns and a recent time since last fire had fewer stems in the understorey and mid-layer strata with fewer species. The results suggest that mid-storey strata may be particularly sensitive to fire, with high intensity and/or high-frequency burns preventing woody species from reaching their full height. This is important when considering vegetation types that require an open or grassy understorey to support certain species (i.e. Eastern Bristlebird). However, more open woodlands have also been found to support higher abundances of the native, but extremely aggressive, noisy miner (*Manorina melanoccephala*) to the detriment of small passerine bird species.

**Fire regimes and plant composition:** The differences in composition among FHCs was driven largely by species classified as canopy and mid-storey, with mid-storey trees being more fire sensitive, as previously discussed. Moreover, whilst the mix of canopy trees varied among FHCs the abundance of those species ( $>6$ m) did not. This may reflect the findings of previous studies whereby a positive relationship has been found between species resilience to fire and tree height and age (i.e. tall/older trees are better able to survive fire).

**Fire regimes and geology:** The authors found that among sites with infrequent fire and a longer time since last fire, abundance and richness was generally higher when located on less-fertile pebbly quartz sandstones. Conversely, sites with frequent fire history and recent time since last fire had a higher abundance and richness of plant species when located on more-fertile basaltic flows.

**Conservation management implications:** The results of this study indicate that less frequently burnt vegetation types, with a longer time since fire, are more complex. This is important as habitat complexity has been found to be positively correlated with vertebrate and invertebrate fauna in other studies. However, within this open eucalypt system, the authors recommend managing for a variety of fire regimes (relevant to specific management objectives) that will help maintain habitat for a diversity of species that vary in their response to fire.



**Photo:** Prescribed burn at Bush Heritage's Carnarvon Station Reserve, QLD in June 2012 within one of Emma's study sites in sandy open woodlands of *Angophora leiocarpa*. Credit Emma Burgess

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