Biodiversity Across the Borders

Climate Change and Future Landscapes

Conference Program and Abstracts

Centre for Environmental Management

Federation University Australia

14th June 2019

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'*Biodiversity across the Borders*' Conference

Theme: "Climate Change and Future Landscapes"

ABSTRACTS

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Victoria

Edited by: S. K. Florentine, G. Palmer and S. Weller

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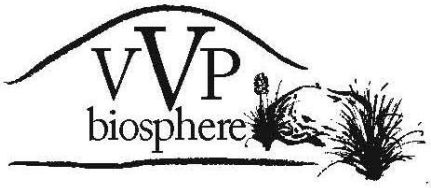
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Eighth Biodiversity Across the Borders Conference – Program

8:00	**Registration** **VENUE**: **1870 Founders Hall Theatre**, Mt. Helen Campus, Federation University Australia	
8:45	**Introduction and Welcome** **PROF. CHRIS HUTCHISON** – DVCR&I, Federation University Australia Federation University Australia	
8:50	**PROF. HELEN BARTLETT** – Vice Chancellor, Federation University Australia **Opening of '*Biodiversity across the Borders*' conference**	
9:00	**Introduced by: PROF. CHRIS HUTCHISON** – DVCR&I, Federation University Australia **Keynote Address:** **PROF. LESLEY HUGHES** (Pro Vice-Chancellor, Macquarie University) Restoration and management of ecosystems in a changing climate: no time left for business as usual	
	VENUE: Caro Main Hall Theatre **CHAIR**: **EMERITUS PROFESSOR MARTIN WESTBROOKE**	
	PLENARY SESSION	
9:35	**PROF. BRENDAN WINTLE** (The University of Melbourne) Six steps to halting Australia's extinction crisis, and how science can help	
9:55	**PROF. MAX FINLAYSON** (Charles Sturt University) Management of waterways and wetlands in a changing climate	
10:15	**PROF. KATHRYN WILLIAMS** (The University of Melbourne) Experiencing nature: psychological perspectives on conservation	
10:35	**BOOK LAUNCH – TITLE:** Wildlife of the Otways and Shipwreck Coast (CSIRO Publishing) **AUTHOR: DR GRANT PALMER** (Federation University Australia) This book will be launched by **PROF. ANDREW BENNETT** (La Trobe University)	
	Morning tea 10:45 – 11:10 **(Poster session)**	
	SESSION 2	
	Species responses to fire VENUE: Caro Main Hall Theatre **CHAIR: DR MATT SWAN**	**Threatened species perspectives** VENUE: Studio Theatre **CHAIR: A/PROF PETER SPOONER**
11:15	**MS. SANDRA PENMAN** The response of bat communities to fire in Foothills Forest of the Otway Ranges	**DR. BEN ZEEMAN** 'Bigger is not always better' – investing in critically endangered ecosystems on private land irrespective of patch size
11:30	**DR. DIANA KUCHINKE** Birds and fire in the heathy dry forests of central Victoria	**DR. JENNY NELSON** The changing status of the Greater Glider in Victoria
11:45	**DR. JODI PRICE** Plant responses to the reintroduction of fire into long unburnt grassy ecosystems in central Victoria	**MR. SIMON HEYES** Unexpected villains? The role of Yellow-tailed Black Cockatoos on recruitment limitation in Silver Banksia (*Banksia marginata*) of Western Victoria
12:00	**MS. MADELEINE GRANT** Mechanical mastication treatment to reduce bushfire risk and enhance ecological values	**MS. JESS LAWTON** Habitat use/persistence of the Brush-tailed Phascogale in relation to landscape change in north-central Victoria
12:15	**A/PROF. EUAN RITCHIE** Ecological and evolutionary considerations for progress in species translocations	**MR. STEFAN GOUWS** Getting to the root cause of declining Coast Banksia (*Banksia integrifolia*) at Wilson's Promontory National Park

12:30	**MR. JOSHUA HODGES** Basalt Plains to the Southern Highlands: above-ground drivers of plant diversity in grassy ecosystems of south-eastern Australia	**DR. DEBBIE REYNOLDS** The current *Pimelea spinescens* story
12:45	Species responses to fire Question and Answer Session	**MR. SIMON VERDON** Land clearing bias has pushed the mallee emu-wren towards a fire response that spells extinction
	LUNCH BREAK 1:00 – 1:45, Albert Coates Complex **(Poster session)**	
	SESSION 3	
	Wetlands and climate change VENUE: Caro Main Hall Theatre **CHAIR**: **Dr. ADAM BESTER**	**Social and citizen science** VENUE: Studio Theatre **CHAIR: PROF. ANDREW BENNETT**
2:00	**DR. JAMES FITZSIMONS** Emerging new models for large-scale private land conservation in Australia: Gayini Nimmie-Caira and the Great Cumbung Swamp	**PROF. DON DRISCOLL** Wildlife to Wellbeing; cross-disciplinary research that uses new technology to engage communities with nature while answering ecological questions
2:15	**PROF. PETER GELL** Sediment-based evidence for natural watering needs of MDB wetlands: tailoring scarce water resources under a drying climate?	**MS. MANDY WATSON** The Southern Right Whales of south-eastern Australia and their Paparazzi
2:30	**MS. KATY LIMPERT** Carbon sequestration in freshwater wetlands	**MS. FERN HAMES** Reimagining a future; 'Mother Nature', Country, Wildspace?
2:45	**MR. IVOR STUART** Climate change and reduced river flows: what can be done to protect native fish populations?	**DR. CAROLINE WILSON** Birds on Farms: engaging the farming community in conservation
3:00	**MS. JASMIN HÄRTEL** Frog hotels for rent - The use of PVC pipes as artificial shelter by frogs in wetlands of Greater Melbourne, Australia	**A/PROF. WENDY WRIGHT** People and tigers: Assessing perceptions of human-wildlife conflict in Nepal
	Afternoon tea 3:00 – 3:30 **(Poster session)**	
	Session 4	
3:45	**Panel Discussion:** Climate Change and Future Landscapes **VENUE: Caro Main Hall Theatre** **CHAIR:** PROF. DON DRISCOLL **Panel Members:** PROF. LESLEY HUGHES; MS. FERN HAMES; PROF. MAX FINLAYSON, PROF. BRENDAN WINTLE, PROF. KATHRYN WILLIAMS; & DR. JOHN WRIGHT	
4:45	**Closing Address:** DR. JAMES FITZSIMONS	

ABSTRACTS
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Poster Abstracts

KEYNOTE ADDRESS

Restoration and management of ecosystems in a changing climate: no time left for business as usual

LESLEY HUGHES

Macquarie University

***Email**: lesley.hughes@mq.edu.au*

Abstract

Climate change is already transforming our ecosystems. Just in the past few years we have seen devastating coral bleaching, mass mortality of mangroves, saltwater intrusion into freshwater wetlands, depletion of snow cover, coastal erosion, penetration of wildfires into rainforests, and even the world's first climate change-related mammalian extinction. Acceleration of the trend toward increased frequency and severity of extreme events will undoubtedly occur for at least the next few decades. The rapidly changing climate is thus moving the goalposts for conservation, and traditional management practices that assume an equilibrial world are simply not good enough. The need for different approaches to conservation in light of the climate change threat has been recognised in the scientific literature for well over three decades. But there remains a huge gulf between recognition of the need for more interventionist action and actual implementation. This talk will briefly summarise the climatic and ecological transformations we have observed already, those that we are likely to experience over the next few decades, address potential ways to bridge the gulf between current practice and reality, and canvas some of the approaches needed to meet the conservation challenge of the 21st century.

Notes:

PLENARY TALK

Six steps to halting Australia's extinction crisis, and how science can help

BRENDAN WINTLE

The University of Melbourne

***Email**: b.wintle@unimelb.edu.au*

Abstract

We have recorded 110 extinctions in Australia since European occupation. The true number is probably much higher. The threats facing species continue to multiply and the rate of species loss is not abating. I will discuss recent work that identifies Australian species most at risk of extinction and the actions needed to avoid those extinctions, including the importance of maintaining and restoring small, remnant habitat patches in rapidly changing agricultural and urban landscapes. I'll discuss the efficacy Australia's targeted threatened species recovery expenditure and present new estimates of the funding required to support recovery of Australia's threatened species.

Notes:

PLENARY TALK

Management of waterways and wetlands in a changing climate

MAX FINLAYSON

Charles Sturt University

Email: *mfinlayson@csu.edu.au*

Abstract

Wetland degradation and loss globally has been documented in a recent Global Wetland Outlook produced by the Ramsar Convention on Wetlands. It showed that globally wetlands were still being lost, not just degraded, with some 35% loss, where we have data, since 1970. Taxa declines, with some heading towards extinction, are also evident. Despite decades of increased attention to environmental policy and management we have not stopped and reversed the loss of wetlands and their biota. Rivers are also in serious decline due to water regulation, the impacts from agriculture, and from invasive species. These global analyses do not specifically contain a lot of data from Australian wetlands and rivers; however, we do know that many of our rivers and wetlands are in dire straits, the expenditure on the Murray-Darling is one indicator. So is the ecological catastrophe in the Darling River. With this backdrop, what can we expect under climate change? The general response has been to say that it will exacerbate the problems, directly as well as indirectly. A wetland in WA has already formally been declared as being degraded because of climate change; I can imagine that there are many more if we had the data and hindsight. In response we need foresight to help guide our management. We have many measures that can help us adapt – to manage now and without regrets, but where is the best investment? Many of these measures are the same as those proposed as being necessary to ensure the Murray-Darling water plan is successful. And some don't see environmental flows as the only necessary response.

Notes:

PLENARY TALK

Experiencing nature: psychological perspectives on conservation

KATHRYN WILLIAMS

The University of Melbourne

***Email**: kjhw@unimelb.edu.au*

Abstract

This presentation considers psychological factors that shape the ways that people connect with ecosystems, plants and animals. It will be grounded in an exploration of human experiences of connection and disconnection with nature. I will first consider emotional experiences such as empathy with other species and awe in the presence of nature, which research demonstrates are salient for conservation behaviour. I will then turn to absence of connection, as seen for example in the phenomenon of 'plant blindness', a tendency observed in many societies associated with weaker knowledge, detection and interest in plants compared with animals. I will place these diverse experiences of connection and disconnection in a broader framework of human-environment interactions, exploring how these connections emerge through complex relationships between physical spaces and organisms, individual human resources and adaptation, activity and social climate. Drawing on this framework and broader research, I will highlight the kinds of experiences that research suggests might promote awareness and action in support of ecosystem conservation. These observations can inform the design of conservation programs through community engagement, education and experiential learning.

Notes:

The response of bat communities to fire in Foothills Forest of the Otway Ranges

SANDRA PENMAN[†,1], BRAD LAW[2] AND ALAN YORK[1]

[1]*The University of Melbourne*
[2]*NSW Department of Primary Industries*

[†]***Email**: spenman1@student.unimelb.edu.au*

Abstract

Fire regimes are changing with our changing climate and in order to mitigate the impacts on our native species we need to understand how species respond to fire. Fire is a major driver of vegetation structure and these changes can alter the diversity and abundance of native fauna. Bats are particularly responsive to changes in vegetation structure, so it is likely that changes in vegetation structure in response to fire will impact on bat community diversity. Bat community activity was measured across a range of time since fire (6 months to 77 years) in the Otway Ranges. All sites were within Foothills Forest, a shrubby dry sclerophyll forest community that is known to undergo structural changes in vegetation with increasing time since fire. Immediately after a fire these forests have an open understorey that becomes dense as the forest regenerates, becoming more open again over time as vegetation senesces. Overall bat activity was not significantly different between fire age classes; however, species richness was more variable at sites of intermediate time since fire (5-10 years). Intermediate age class sites have denser midstorey vegetation which is likely to restrict foraging opportunities and impede movement. This work suggests that time since fire is not a good predictor of bat communities and a mechanistic approach is required in order to understand their fire responses. Understanding and quantifying these site scale changes in diversity will allow us to model how landscape fire regimes impact bat assemblages over time, leading to improved conservation management planning for bat communities in forested landscapes.

Notes:

Birds and fire in the heathy dry forests of central Victoria

DIANA KUCHINKE

Federation University Australia

Email: *diana@kuchinke.com.au*

Abstract

The forests and woodlands of central Victoria are home to birds that are currently under intense pressure from the effects of extensive agricultural practices, repeated fires and a drying landscape. These pressures are resulting in a reduction of the resources necessary for their survival. While most birds in this region seem quite resilient to the impact of repeated burns, and in fact many increase in abundance amongst flowering new growth, there is an important statistic to bear in mind. In the Heathy Dry Forest of central Victoria, 90% of the bird community abundance comprises only 17 species. A further 16 species make up another 9%. The final 1% comprises 23 uncommon species. The landscape is such that those that best survive are our most common birds. The remaining are much reduced in number, suggesting a struggle with the fact that suitable habitat is greatly reduced - a trend that is continuing. This presentation will give an overview from a completed PhD, on bird fire responses in the Heathy Dry Forest of central Victoria, highlighting results that illustrate how even the most common birds will be impacted. In fact, results from two common species, the Laughing Kookaburra and the White-throated Treecreeper, show how current changes in the landscape are impacting their necessary resources.

Notes:

Plant responses to the reintroduction of fire into long unburnt grassy ecosystems in central Victoria

JODI PRICE[1,†], MICHAEL CLELAND[1], JOSHUA HODGES[1], LYDIA GUJA [2,3] AND DALE NIMMO[1]

[1]*Charles Sturt University*
[2]*Australian National Botanic Gardens*
[3]*Commonwealth Scientific and Industrial Research Organisation*

[†]***Email**: joprice@csu.edu.au*

Abstract

Temperate grassy ecosystems in southern Australia have been decimated since European occupation, and the few remaining remnants are mostly degraded and fragmented. Changes in disturbance regimes had dramatic and rapid effects—the removal of fire and introduction of livestock grazing resulted in the local extinction of grazing sensitive and fire-dependent species. Hence, many of southern Australia's grasslands have remained unburnt for decades, and have been heavily degraded by other disturbances in the interim (e.g., livestock grazing). Recently, fire has been re-introduced into long unburnt landscapes to restore both biodiversity and Indigenous connection to country. This provides a rare opportunity to examine if the return of cultural burning can restore plant diversity. The response of plant communities to the re-introduction of fire in these landscapes are difficult to predict, and the few studies that have been conducted have reported a range of responses. We explored plant community responses to the re-introduction of cultural fire in central Victoria. We sampled burnt and unburnt plots in four grassy ecosystems in central Victoria. Plots were monitored immediately after the fire and at monthly intervals thereafter. At each monitoring time, data were collected on bare ground, litter, vegetation cover, structure (using the golf ball method), soil moisture and light availability to determine the main drivers of plant diversity. Photos were also taken of each plot for processing in ARC GIS (cover of burnt, litter, green vegetation and bare ground calculated). Plant species richness and composition were sampled in spring. Resources (soil moisture and light) and structural variables (openness, biomass) differed in burnt and unburnt plots through time. However, species richness did not differ between burnt and unburnt plots. The lack of plant responses to the re-introduction of fire suggests ecosystems are relatively stable and fire-dependent species may be lost and require active restoration through seed addition.

Notes:

Mechanical mastication treatment to reduce bushfire risk and enhance ecological values

MADELEINE GRANT

The University of Melbourne

Email: *mgrant@student.unimelb.edu.au*

Abstract

Shrub encroachment, where grassland and woodland ecosystems become heavily dominated by one or two shrubs species is a growing concern for ecosystem managers. It can reduce the ecological value of a site by shifting community composition and structure, decreasing species diversity. It presents a further challenge for land managers as the dense elevated shrub layer can increase fire rates of spread and intensity. Mechanical mastication involves mulching or chipping the understory trees and shrubs and redistributing the woody debris to the surface layer. Yet, there is little research to gauge its effectiveness in these shrub encroached ecosystems. We sought to quantify the impact of mastication by measuring fuel properties (Overall Fuel Hazard, fuel load) and flora species diversity within fifteen paired sites (masticated versus unmasticated control; n=30) across Victoria. Mastication was associated with a reduction in overall fuel hazard, despite a two-fold increase in surface fine fuel load relative to unmasticated controls. This result suggests bushfire risk may be less in masticated fuels. However, Australian fire behaviour models do not account for surface course fuels, which increased fourfold in abundance (tonnes per hectare) in the masticated sites. There was also a reduction in moisture content in masticated fuels compared to controls, suggesting masticated fuels are available to burn more often. There was no difference in species richness, however, species diversity (calculated using the Shannon's Diversity Index) was higher in mastication treatments, suggesting mastication has positive benefits for flora biodiversity. Further research is needed to incorporate the results of this study into bushfire risk models. The ability to quantify the effectiveness of these treatments will be crucial for land managers to make informed decisions about managing bushfire risk and conserving ecosystems into the future.

Notes:

Ecological and evolutionary considerations for progress in species translocations

EUAN RITCHIE[†,1], BEN PHILLIPS[2], WILL BATSON[3], CHRIS JOLLY[2] AND GRAEME FINLAYSON[4]

[1]Deakin University
[2]The University of Melbourne
[3]ACT Parks and Conservation Service
[4]Bush Heritage

[†]***Email***: e.ritchie@deakin.edu.au

Abstract

Australia has a rapidly expanding threatened and extinct species list that continues to erode this continent's unique flora and fauna. In response to ongoing threats, there is an increasing need for proactive conservation and management actions. When successful, species reintroductions can provide important conservation outcomes, but also stories of hope for the public in an otherwise pessimistic landscape of declines and despair. Unfortunately, species reintroductions very often fail. Why? For Australian mammal species, failure is often attributed to predation by feral cats and/or foxes, including in some cases where the cause of death is uncertain. What is less often considered, quantified and understood, however, is the important role that the introduction environment, and the traits of the introduced individuals play in determining success. Environmental factors such as habitat (cover and complexity), and food availability (for both introduced individuals and feral predators) determine levels of exposure to predation. Traits of introduced individuals, including, social structure, antipredator behaviours, and their background genetic health also have a powerful influence on the success or failure of species translocations by determining vulnerability to that exposure. Release strategy (soft vs. hard) and whether dispersal of introduced individuals is free or initially limited, are also important factors potentially affecting translocation outcomes. Despite this, these factors are often given insufficient consideration in the experimental design of reintroductions. With reference to recent mammal translocations (e.g. northern quolls from Astell Island to mainland NT and eastern bettongs in the Lower Cotter Catchment, ACT), and where critical weight-range mammals still persist in the presence of invasive predators outside of sanctuaries, we discuss key lessons that emerge that could be used to rapidly increase the success of future species translocations. Given the emerging tools that can be applied to species translocations (e.g. predator-aversion training and targeted gene flow), we argue that it is premature to accept that certain species, such as bettongs, cannot persist outside of predator-free havens or islands.

Notes:

Basalt Plains to the Southern Highlands: above-ground drivers of plant diversity in grassy ecosystems of south-eastern Australia

JOSHUA HODGES[†,1,2,3], LYDIA GUJA[1], ADRIENNE NICOTRA[2] AND JODI PRICE[3]

[1]*Australian National Botanic Gardens*
[2]*The Australian National University*
[3]*Charles Sturt University*

[†]***Email**: johodges@csu.edu.au*

Abstract

Competition for resources such as light and space is often thought to be the primary driver of plant diversity in grassy ecosystems. Thus, understanding variation in competitive intensity has become integral to understanding the ecology of these ecosystems. Above-ground competition is often thought to vary across rainfall gradients, in sites dominated by different grass-types (C_3 or C_4 photosynthetic pathway) and with disturbance history due to differences in productivity (accumulation of biomass and litter) and structure (percentage cover of tussocks relative to bareground and litter). However, studies investigating diversity patterns often focus on small rainfall gradients and sites with similar disturbance histories and thus do don't capture the significant heterogeneity in productivity and structure present across broad-scales. We aimed to quantify the effect of variables relating to productivity and structure on plant diversity across a broad geographical range. Ten 1 x 1 metre plots were sampled along 42 transects (=420 plots) within 27 sites ranging from the Southern Highlands in NSW to the Volcanic Plains in south-western Victoria. Linear Mixed Models showed that structural variables such as litter, bareground and tussock cover strongly influenced diversity with evidence of both linear and non-linear relationships ($p < 0.01$, Nakagawa-Schielzeth R^2 = 0.86). Phytomass accumulation (gm^2, i.e. productivity) negatively influenced diversity, but explained less of the variation in plant diversity compared with structural variables ($p < 0.05$, Nakagawa-Schielzeth R^2 = 0.69). Variables relating to structure (tussock, bareground and litter cover) and productivity (phytomass accumulation) were correlated with annual rainfall, identity of the dominant grass and disturbance history. These results highlight linear and non-linear relationships between structural variables and plant diversity; and the negative relationship between productivity and diversity over broad-scales. This study sheds new light on the ecology of grassy ecosystems and has important implications for management and restoration.

Notes:_____

‘Bigger is not always better’ – investing in critically endangered ecosystems on private land irrespective of patch size

BEN ZEEMAN† AND AGGIE STEVENSON

Glenelg Hopkins Catchment Management Authority

†***Email:*** *b.zeeman@ghcma.vic.gov.au*

Abstract

Conservation policies around the world have been heavily influenced by island biogeography theory. This has created a preference for protecting large habitat patches with strong connectivity across the landscape over small isolated patches. However, recent research on the topic has begun to question this logic, with data identifying the importance of small habitat patches in human dominated landscapes. At the Glenelg Hopkins CMA, we work with farmers on the Victorian Volcanic Plain to protect and manage critically endangered ecological communities. Traditional methods of prioritization have been heavily influenced by island biogeography principles. However, considering recent research, we undertook an examination of species richness and diversity patterns across the landscape, and examined how these patterns relate to remnant size before determining investment priorities. Using a methodology that has been widely used to examine remnant grasslands close to Melbourne, detailed vegetation surveys were undertaken across 45 privately owned remnants, including temperate grassland and seasonal herbaceous wetland. We recorded a total of 198 native plant species, however, 76% of species were confined to fewer than 20% of sites, emphasizing the restricted distribution of most species on private land. When testing island biogeography theory, we found no relationships between species richness, diversity or weed invasion, and remnant size. In addition, holding area constant, small sites scattered across the landscape provided habitat for more species then the equivalent area in large sites. Small sites also provided habitat for many species not found in the large sites, while there were very few unique species found only in large sites. The findings from the work have implications for how we now invest in protecting these critically endangered ecosystems, as we move away from a heavy focus on remnant size, to a stronger focus on species richness, diversity and non-native plant cover.

Notes:

The changing status of the Greater Glider in Victoria

JENNY NELSON†, LOUISE DURKIN, MICHAEL SCROGGIE, JEMMA CRIPPS, LUKE EMERSON, TIARNE ECKER, DAVID RAMSEY AND LINDY LUMSDEN

Arthur Rylah Institute

†***Email***: *Jenny.Nelson@delwp.vic.gov.au*

Abstract

Once considered common in Victoria, the Greater Glider has declined in recent decades and is now listed as Threatened. Evidence of declines have mostly come from surveys in East Gippsland, and the ash forests of the Central Highlands. However, the status of many populations is unknown. This information is critical to inform the development of targeted management actions. To assess current densities, we undertook surveys in two areas of the species' range. We used mark-recapture distance sampling to estimate the density of gliders on 500 m off-track transects at 105 sites. Habitat attributes likely to influence the presence and abundance of gliders were also measured. We found marked differences in Greater Glider densities between these two areas. In the Strathbogie Ranges, North East Victoria, we observed 121 Greater Gliders across 25 transects with a mean detection rate of 4.92 individuals per transect (range 0-14). We found significant positive relationships between the abundance of gliders and tree size, and the basal area of eucalypt species associated with fertile soils and high rainfall. In contrast, surveys across the Central Highlands and surrounding foothills, which included both ash and mixed-species forest, found low numbers of gliders. Here we observed only 66 gliders across 80 sites, with a mean detection rate of 0.93 individuals per transect (range 0-6). No Greater Gliders were found on almost 60% of these transects. In this area we found no relationships between the abundance of gliders and any of the habitat variables measured on-site, or any of the GIS-derived environmental variables considered. As a forest-dependent species, Greater Gliders are subject to a range of threats including bushfires, timber harvesting and planned burning. Climate change impacts through more extreme droughts and higher temperatures are likely to also negatively impact this heat-sensitive species, and climate refuges may become increasingly important in the future. Why so few gliders were found in our Central Highlands study area despite the presence of apparently suitable habitat, compared to the higher densities in the Strathbogie Ranges is unknown, but highlights the patchy nature of the recent decline. Further surveys throughout the species' range, using our mark-recapture distance sampling approach, would provide rigorous and comparable information to identify other areas of high densities to inform conservation management and to assist in determining the causes of decline.

Notes:

Unexpected villains? The role of Yellow-tailed Black Cockatoo's on recruitment limitation in Silver Banksia (*Banksia marginata*) of Western Victoria

SIMON HEYES[1,†], SUSAN HOEBEE[1], STEVE SINCLAIR[2] AND JOHN MORGAN[1]

[1]*La Trobe University*
[2]*Arthur Rylah Institute*

[†]***Email:*** *S.Heyes@latrobe.edu.au*

Abstract

Silver Banksia savannahs on Victoria's western grassy plains have suffered from extensive historic land clearing, leaving small and highly fragmented remnants surrounded by an intensively farmed landscape. Small fragmented populations are vulnerable to many threats including inbreeding, altered fire regimes and introduced herbivores; however, more novel threats such as native avifauna can often be overlooked. Anecdotal observations have reported that Silver Banksia savannahs are suffering from widespread recruitment bottlenecks and a failure to produce fruit, with pre-dispersal seed predation by Yellow-tailed Black Cockatoos thought to be involved. To investigate the impact of pre-dispersal seed predation on fruit crops we quantified the amount of fruit being removed at four different Silver Banksia populations across Western Victoria. We also looked at the impact of pre-dispersal seed predation timing on seed fitness by removing fruit at different times in their development to look at seed mass, germination, viability and proportion of fruit that opened. We found that most sites had mature trees without fruit and some sites had 100% removal of fruit in a season. Coupled with existing limits on tree recruitment in savannahs, such as grass competition, fire and herbivory, we argue that pre-dispersal cockatoo granivory is likely to be a significant contributor to recruitment limitation in savannah fragments by decreasing the pool of seed prior to dispersal.

Notes:

Persistence of a threatened species, the Brush-tailed Phascogale, in a depleted and fragmented environment

JESS LAWTON [1,2, †], GREG HOLLAND[1] AND ANDREW BENNETT [1,2]

[1]*La Trobe University*
[2]*Arthur Rylah Institute*

[†] ***Email***: *lawton.j@students.latrobe.edu.au*

Abstract

Determining the ability of threatened species to persist in modified landscapes is a key issue for conservation worldwide. The Brush-tailed Phascogale has undergone a decline in numbers and range contraction in Victoria, it relies on a declining resource (tree hollows) to reproduce, and lies within the critical weight range of mammal species with a profound risk of decline. Yet, in some landscapes this species persists despite marked habitat loss, fragmentation and disturbance. An environmental community group, 'Connecting Country', has installed some 450 nest boxes for this species in a fragmented landscape in central Victoria, and has monitored a subset of these boxes since 2011. We analysed nest box data collected by Connecting Country to examine whether nest box use changed through time, and to determine which tree-, site- and landscape-level factors influence nest box use by this species. We also used remote cameras to survey for the brush-tailed phascogale at a subset of 50 of these sites, to investigate the effect of site- and landscape- level factors, and predation, on the occurrence of this species. The Brush-tailed Phascogale was widespread in the study region, indicating that this area is a stronghold for this threated species. We discuss the reasons for this species persistence in this system, and which factors influence nest box use and occurrence of this species.

Notes:

Getting to the root cause of declining Coast Banksia (*Banksia integrifolia*) at Wilson's Promontory National Park

STEFAN GOUWS†, JOHN MORGAN AND PETE GREEN

La Trobe University

†***Email:*** *17682104@students.latrobe.edu.au*

Abstract

Forested ecosystems cover 30% of the world's surface, providing valuable habitat for wildlife and supporting diversity. However, forests are vulnerable to a range of biotic and abiotic stressors including drought. Recently it has been shown that shrub encroachment can act synergistically with drought to cause the decline of overstorey trees. Coast Banksia decline at Wilson's Promontory National Park has been well documented since the 1970's, yet no single cause has been found. Coast Banksias are foundational species in the grassy woodlands at Wilson's Prom, providing hollows for nesting sites and floral resources for native wildlife. The coastal grassy woodlands have been subjected to large scale shrub encroachment by Coast Tea-tree. This study investigated the decline of Coast Banksia trees due to shrub encroachment. We hypothesised that Coast Banksia can access groundwater resources, that the presence of a shrub layer limits water availability for Coast Banksia individuals and that there is a negative relationship between water stress of individuals when surrounded by a dense shrub understorey. In a glasshouse experiment we found that Coast Banksia have a dimorphic rooting system that enables them to access groundwater resources. Our natural experiments found that encroachment limits water availability for Coast Banksia, especially at depth, and that coast banksia individuals surrounded by shrubs had a higher degree of water stress compared to unencroached banksias. Our results indicate that water stress of shrub encroached Coast Banksia leads to lower productivity and that shrub encroachment is contributing to the decline of Coast Banksia across Wilson's Promontory National Park.

Notes:

The current *Pimelea spinescens* story

DEBORAH REYNOLDS

Victoria University

Email: *deborah.reynolds@live.vu.edu.au*

Abstract

Pimelea spinescens subsp. *spinescens* is an endemic subshrub found within temperate grasslands of the Victorian Volcanic Plains. It is listed as critically endangered under the Federal *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Efforts to bolster populations using horticultural techniques had been largely unsuccessful. For long-term survival it is necessary to successfully germinate seed and employ methods which encourage wild populations to reproduce *in situ*. The aim of my research was to identify which factors of the biology, ecology and management of *P. spinescens* populations, significantly affect the species *in situ* recruitment potential. The more recent research looked at what affects its reproductive potential and how can we establish it *in situ*. The PhD research developed both laboratory and field methods for the collection of demographic data, assessments of viability, germinability, *in situ* germination and survival. These components were used as measures of recruitment potential which were assessed for relationships with a range of environmental and management variables. Field assessments were undertaken at 16 sites over a two year period and demographics were assessed again in 2018. *Pimelea spinescens* seed displayed an endogenous non-deep physiological dormancy (Type II), which was partially overcome *in vitro* using gibberellic acid treatments. *In situ* germination and survival appeared to be the most critical stages to the recruitment success of *P. spinescens* populations. Population density and specifically female density were found to positively influence germinant recruitment. But overwhelmingly the recruitment potential of *P. spinescens* populations was most strongly associated with regimes of biomass reduction events. Reduced litter, weeds, greater bare soil, a high indigenous species diversity, all contributed to a high site condition score and were positively associated with the survival of *P. spinescens*. Since 2013, further research regarding the effects of specific biomass treatments on flowering and seed production was collected at a single site. From 2013 to 2018, establishment of seedlings at two different sites (grassland and ploughed wildflower field) and two biomass treatments were carried out compared to a control. Flowering and seed production was found to be positively influenced by the burn biomass reduction event. Disturbed soil (ploughed) and no established grasses was found to benefit seedling survival in the field. The management implications are that frequent burning and disturbed soil will promote a seedling's survival and mature plant's flowering and seed production.

Notes:_____

Land clearing bias has pushed the mallee emu-wren towards a fire response that spells extinction

SIMON VERDON†, SIMON WATSON AND MICHAEL CLARKE

La Trobe University

†***Email:*** *s.verdon@latrobe.edu.au*

Abstract

When soldier settlers started clearing mallee woodlands for agriculture in the post-war period, they did not do so randomly. Instead they cued into subtle changes in topography, soils and vegetation that indicated which areas were most fertile (these were cleared) and which areas were least fertile (these survived). This biased land-clearing, which focussed on fertile soils has caused widespread declines in many mallee bird species. Historically, birds would have retracted to these fertile areas in drought, and recolonised the surrounding landscape when the drought broke. For the mallee emu-wren, the effect of biased land-clearing has been even greater than for other species that lost their drought refuges. I present data showing that across most of the mallee emu-wren's range today, the mallee emu-wren is a "mid-successional specialist", meaning that it prefers vegetation with 40-70 years since fire. However, in a small number of fertile drought refuges that were never cleared, the mallee emu-wren occupies a much broader range of fire-ages (25-120 years since fire). Thus, by favouring fertile areas during historic clearing, we have pushed the mallee emu-wren towards a novel fire response characterised by mallee emu-wrens occupying a site for only 30 years, rather than for 100 or more years as seen in fertile areas. This discovery helps explain why a dispersal-limited species like the mallee emu-wren has a fire-response that requires frequent dispersal to access new habitat with an appropriate fire-age. Historically this species would have had much lower dispersal requirements due to the longevity of habitat. This discovery also acts as a guide for future conservation management for this species. To save the mallee emu-wren we will need to 1) give priority management to the small number of fertile areas that have never been cleared and 2) Identify cleared fertile areas that are suitable for revegetation.

Notes:

Emerging new models for large-scale private land conservation in Australia: Gayini Nimmie-Caira and the Great Cumbung Swamp

JAMES FITZSIMONS[1,2,†], RENE WOODS[1], RICH GILMORE[1], DEBORAH NIAS[2], NATALIE HOLLAND[1], KATHRYN RIDGE[2], JANE HUTCHINSON[1] AND RICHARD KINGSFORD[3,4]

[1]*The Nature Conservancy*
[2]*Deakin University*
[3]*Murray Darling Wetlands Working Group*
[4]*University of New South Wales*

[†]***Email:*** *jfitzsimons@tnc.org*

Abstract

Private land conservation in Australia varies in approach from non-binding schemes such as NRM-focused landcare and wildlife habitat-focused 'Land for Wildlife' programs, through to perpetual binding conservation covenants and land purchased as private reserves by non-government organisations. The recent acquisition of two large properties in the southern Murray-Darling Basin, highlights both different approaches to ownership and governance of large, complex conservation properties and the challenges of restoring nationally-important freshwater ecosystems in the face of climate change. The Gayini Nimmie-Caira property is approximately 84,000 hectares of freehold land covering nationally-significant open lignum floodplain, River Red Gum and Black Box woodlands as well as grasslands and chenopod shrublands in the lower Murrumbidgee Valley, making it one of the largest single private holdings in the Riverina bioregion. The $180 million Nimmie-Caira water saving project, saw the New South Wales and Australian governments purchase 19 properties on the Nimmie-Caira floodplain, together with associated water rights which helped meet Sustainable Diversion Limits for the Murray-Darling Basin Plan. With the aim of delivering environmental flows and ensuring long-term sustainable land management, the NSW Government invited tenders for the future management of the property. In 2018, a consortium including the Nari Nari Tribal Council, The Nature Conservancy, Murray Darling Wetlands Working Group and University of NSW successfully tendered for the stewardship of Gayini Nimmie-Caira with an integrated economic, social, cultural and ecological vision for Gayini Nimmie-Caira system. Nimmie-Caira represents a different type of private land conservation model, with government playing an important and direct initiating and facilitating role to enable a large-scale private land conservation outcome. Long-term conservation will be ensured through a legally-binding Land and Water Management Plan, easements and an exploration future Ramsar-listing. In 2019, a joint venture initiative between The Nature Conservancy and Tiverton-Rothwell Agriculture, saw the purchase of Juanbung and Boyong stations spanning 33,765 hectares, and associated water rights, for $55 million. These properties to the north of Gayini Nimmie-Caira, contain the majority of the Great Cumbung Swamp, one of the largest reed swamps in the Murray-Darling Basin and the confluence of the Lachlan and Murrumbidgee rivers. The Great Cumbung will be managed for conservation and sustainable grazing with protective agreements placed on the title over time.

Sediment-based evidence for natural watering needs of MDB wetlands: tailoring scarce water resources under a drying climate?

PETER GELL

Federation University Australia,

Email: *p.gell@federation.edu.au*

Abstract

The floodplain wetlands of the southern Murray Darling Basin have been subject to the impacts of catchment and water resource development for more than a century. The degradation of the waterways has been attributed to the regulation of the rivers and abstraction of water volume for irrigation agriculture. The MDB Plan was enacted in 2012 to return at least 2750 GL of flow to the system to restore the natural character of waterways. Considerable recent investment in infrastructure enables water to be released into floodplain wetlands. The proposed watering regime is underpinned by hydrological modelling which suggests that, before regulation, overbank flows would have occurred in most years as discharge peaked in winter and spring. Sediment records have been extracted from over fifty floodplain wetlands down the length of the Murray and Murrumbidgee Rivers. The records from several, large meander wavelength billabongs extend for 1000 -5000 years suggesting that these sites were permanently inundated over that time. Others extend only to <300 years and so are presumed not to have accumulated sediment until then. The records of most wetlands however, only extend to the onset of river regulation in the 1920s, suggesting that prior to then, contrary to the modelling, they were not inundated for sufficient duration for net accumulation to occur. Preserved diatoms attest to shallow, plant dominated systems in the past and many have transitioned to deep, turbid water systems today. As the river is identified as a source of sediment influx into wetlands, less regular watering, rather than more, is a viable option in restoring the ecological function of these floodplain wetlands by avoiding rapid sediment infill. Evidence of the historical watering regime may inform on the resilience of wetlands to drying enabling managers to better tailor measures aimed at long-term rehabilitation.

Notes:

Carbon sequestration in freshwater wetlands

KATY LIMPERT

Deakin University

***Email**: klimpert@deakin.edu.au*

Abstract

Interest in conserving and rehabilitating ecosystems that reduce atmospheric greenhouse gas concentrations is increasing with the need for actions that mitigate global warming. Freshwater wetlands have the capacity to act as both substantial carbon sinks and potential carbon sources, highlighting the importance of research that helps better understand this balance shift in the context of the global carbon budget. Although freshwater wetlands store carbon and provide other important ecosystem services (i.e. flood mitigation, improved water quality, supply of water resources), their value has been underappreciated, resulting in considerable loss of wetland area. Globally, freshwater wetlands have decreased by up to two thirds of their original expanse. Currently, there is limited knowledge regarding best management practices for freshwater wetland carbon dynamics, in part due to the countless number of variables acting on these systems. Our research highlights patterns of freshwater wetland carbon cycling across several agricultural and management practices including: cropping, grazing, environmental watering, feral species management, and rehabilitation. The aim of this research is to identify key drivers of carbon retention and release from wetlands under different management regimes. Results from these studies will ultimately provide guidance about how and where freshwater wetland conservation and rehabilitation should occur to maximise carbon offset opportunities.

Notes:

Climate change and reduced river flows: what can be done to protect native fish populations?

IVOR STUART[1,†], JAROD LYON[1] AND CLAYTON SHARPE[2]

[1]*Arthur Rylah Institute,*
[2]*NSW National Parks & Wildlife Service*

[†]***Email*:** *ivor.stuart@delwp.vic.gov.au*

Abstract

Climate change, along with river regulation and consumptive water use have caused major changes to the hydrology of rivers globally and their cumulative impact continues to challenge restoration efforts. Within many of the inland rivers of south-eastern Australia, flows are reduced by at least 50%, and increasingly catchments are subject to more frequent and severe dry spells. Reduced riverine flows means that aquatic habitats and native fish have become particularly vulnerable and further major contractions in species distributions and abundance are expected over the next 10-15 years. Floodplains have also suffered, with many now rarely inundated. The most severe impacts are already evident for fish species which: (i) depend on regular connectivity between rivers and floodplains, and (ii) for threatened species that only occur in a few remaining permanent wetlands, such as Murray hardyhead (*Craterocephalus fluviatilis*). To protect rivers and floodplains, there needs to be a management shift away from an individual site or river-based philosophy to: (i) regional protection of baseflows and small flushes to regularly connect rivers and wetlands, (ii) a renewed focus on expanding threatened wetland fish populations to a broader range of drought refuges, and (iii) explicitly integrating irrigation networks into native fish recovery. These new directions will help improve and expand native fish populations, especially against a back-drop of climate change.

Notes:

Frog hotels for rent - The use of PVC pipes as artificial shelter by frogs in wetlands of Greater Melbourne, Australia

JASMIN HÄRTEL

The University of Melbourne

***Email**: jhartel@student.unimelb.edu.au*

Abstract

Wetlands in urban environments can be important habitat for frogs, but only if the surrounding terrestrial habitat provides resources frogs require. Terrestrial habitat such as vegetation, rocks and debris are often cleared or minimised in urban wetlands for public safety and aesthetics, thus reducing shelter available for frogs, adding to the various challenges presented by the urban environment. Artificial habitat may be useful in such circumstances to provide frogs with additional shelter. PVC pipes have successfully been used internationally as a sampling technique for tree frogs, with frogs colonising pipes in as little as seven days. This study investigated the use of PVC pipes and agi pipes as artificial shelter for frogs across 20 wetlands on the urban-rural fringe of Melbourne, Australia over one year. I tested whether the use of pipes by frogs varied with season, species, pipe diameter, pipe orientation, pipe temperature and habitat features. *Litoria ewingii* was the only frog species found to inhabit pipes, and was only found in the most densely vegetated sites with highest frog density. *Litoria ewingii* only inhabited vertical pipes, but was found in all pipe diameters, sometimes with multiple individuals residing in a single pipe. I am currently logging the temperature in pipes and other microhabitats. These data may reveal further information on potential seasonal patterns of pipe use by frogs. It would be interesting to examine the impact of pipes on frog populations. A longer study period is needed to determine if different species may colonise pipes over time. This study is the first in Australia to corroborate the use of PVC pipes by tree frogs.

Notes:

Wildlife to Wellbeing: cross-disciplinary research that uses new technology to engage communities with nature while answering ecological questions

DON DRISCOLL†, TOIJA CINQUE, ABBAS KOUZANI, JUSTIN LAWSON, SENG LOKE, JASON MAJOR, CHRISTOPHER MCAVANEY, THANH NGUYEN, CHRIS RAYMOND, SHUDDHA RAFIQ, SEAN REDMOND, NATHAN SEMIANIW AND ALEX TOMY

Deakin University

†***Email***: *d.driscoll@deakin.edu.au*

Abstract

Conservation biologists need new technology to gather better ecological data that can support informed management decisions. But biodiversity conservation also depends on broad community backing and engagement with nature so that decisions favouring conservation have social licence and political support. Further, engagement with nature can improve human wellbeing, providing incentives for conserving biodiversity. We describe an integrated cross-disciplinary approach to conservation biology spanning ecology, engineering, IT, health and economics. Our project engages small-property owners as citizen scientists to deploy 'Deakin Cams' and collect 'big data' on small animals including frogs and lizards. Our web site facilitates social interaction, data-base management and community-contributions to classifying wildlife in video. Labelled video feeds back to machine learning analyses that will automate species identification as the database accumulates, with potential for long-term automated data collection. The data will help evaluate impacts of planned burning on small animals, and our pre and post-activity surveys will evaluate wellbeing and engagement among participants. Economic evaluation of costs and benefits can help communicate any advantages of this approach to potential funders for future applications.

Notes:

The Southern Right Whales (*Eubalaena australis*) of south-eastern Australia and their Paparazzi

MANDY WATSON

Department of Environment, Land, Water and Planning

Email: mandy.watson@delwp.vic.gov.au

Abstract

Southern Right Whales in Australian waters were hunted to the brink of extinction at the turn of the last century. Approximately 19,000 southern right whales were harvested from south-east Australia alone. Historically, much of the western Victorian, eastern Tasmanian and southern New South Wales (NSW) coastline were considered high-use areas for the species. It is thought that local extirpation has led to a loss of cultural memory of calving sites contributing to the limited recovery of the south-eastern Australian population and knowledge of population demographics of the south-eastern Australian Southern Right Whale population is lacking. Photo-identification is a non-invasive method that can be used to investigate the distribution, movement and population trends of cetaceans. Southern Right Whales have unique callosity patterns (patches of thickened, keratinised tissue) around the head that allow the easy photo-identification of individuals. The Department of Environment, Land, Water and Planning (DELWP) has been conducting photo-identification research on Southern Right Whales since 2002. In recent years citizen scientists have been becoming an increasingly important source of data for DELWP's Southern Right Whale photo-identification research program.

Notes:

Reimagining a future: 'Mother Nature', Country, Wildspace?

FERN HAMES

Arthur Rylah Institute

***Email**: Fern.Hames@delwp.vic.gov.au*

Abstract

How do we connect with, and act for, nature? How have we connected in the past, today, and how might that change in the future? People are spending less time in nature than ever before, and natural places, especially true wildernesses, are in decline. Recent research by the Department of Environment, Land, Water and Planning has helped us understand the current shape of Victorians' connections with, and actions for nature. We know that older women, in particular, are highly connected with nature and active in caring for nature. We know that direct physical experience of a place is powerful and that whilst people feel most connected to 'wild' nature, urban or modified nature is also important for fostering connection. But what will the future look like, and how do we evolve nature advocacy and action, in a technology-enriched world, in a diverse community, and in a world where increased visitation from nature lovers might pose increased impacts our declining wildspaces? How do we grow a sense of reciprocity; of 'caring for Country', of advocacy and stewardship, from the whole community? And how can this help reverse the decline in biodiversity, locally and globally?

Notes:

Birds on Farms: engaging the farming community in conservation

CAROLINE WILSON†, CHRIS TIMEWELL AND DEAN INGWERSEN

BirdLife Australia,

†***Email**: caroline.wilson@birdlife.org.au*

Abstract

Birds on Farms is a citizen science monitoring program for farmers and other rural landholders, scientists, birdwatchers and the general public. The program aims to learn more about birds and their habitats on private rural properties – and to use this information in woodland bird education, conservation and habitat enhancement. It also builds on an earlier program which ran from 1995 to 1997, and through engaging original landowners it will allow us to analyse changes in habitat and bird diversity over time. The program is currently restricted to Victoria but will soon commence in NSW, and we are looking to extend it into other states. Here we will discuss initial findings from the Birds on Farms program, management implications and future directions.

Notes:

People and tigers: Assessing perceptions of human-wildlife conflict in Nepal

BABU BHATTARAI[1], WENDY WRIGHT[1,†], SIMON COOK[1] AND DAMIAN MORGAN[1]

[1]*Federation University Australia*

[†]***Email***: wendy.wright@federation.edu.au

Abstract

Local communities play vital roles in the protection and conservation of wildlife, even when the species that they protect present significant risks to lives and livelihoods. In Nepal, tigers and leopards are known to opportunistically kill livestock and are also of concern for human safety. We interviewed residents in communities adjacent to Bardia and Chitwan National Parks between April and November January 2017. Participants were asked to recall and report incidents of livestock loss due to large cats (tiger and leopard) which had occurred over the preceding five years. They were also asked about their perceptions of wildlife (specifically tigers) and their attitudes towards tiger conservation. Of 422 participating households, 121 (29%) reported incidents of livestock losses in the previous five years. Not all were able to provide details regarding the type and number of losses. We therefore analysed losses of 158 domestic animals in 129 incidents from 98 households in the reporting period (2013-2017). Livestock depredation was highest for goats (87), followed by cows (38), pigs (29), buffalo (3) and sheep (1). The species of predator was ascribed in all but 1.3% of cases. Tigers were held responsible for 41.7% of animals killed; including both large and medium livestock. Leopards were associated with 57% of livestock deaths, all of which were medium sized animals (goats, sheep and pigs). The mean number of animals lost per household per year was 0.32 (SD 1.0). The mean reported economic value of these losses was NRs 2,502 ± SD 1,895 (US $22.4 ± 16.9) per household per year. In most cases, predators killed or took livestock from night shelters (76%) or buffer zone forest areas (19.2%). Some were taken from crop fields (4.8%). Almost three quarters (72.8%) of participating households did not have predator-proof corrals. In spite of these losses, positive attitudes towards tiger conservation initiatives were typical.

Notes:

Poster Abstracts

Developing a climate adjusted provenancing plot network for Victoria

SACHA JELLINEK[1,2,†], ELISA RAULINGS[1], ALISTAIR PHILLIPS[1] AND ADAM MILLER[3]

[1]*Greening Australia*
[2]*La Trobe University*
[3]*Deakin University*

[†]***Email***: *sjellinek@greeningaustralia.org.au*

Abstract

Climate change is having measurable impacts on our land, water and biodiversity. In line with climate-driven impacts on the natural environment, there is a pressing need to understand and plan for the climate impacts on restored habitats and develop guidelines to implement and monitor climate adapted plantings and seed production areas. These areas have the potential to improve habitat resilience of native flora and fauna within the wider landscape and provide empirical data to develop effective adaptive management strategies in the face of uncertainty. By including a diversity of species and seed provenances in revegetation projects, we can maximise the resilience of plantings to climate change and other environmental stressors. In Victoria we plan to develop guidelines for climate adapted plantings to help restore native, biodiverse habitats under a changing climate. Some of the key questions of this project will focus on selecting a diversity of species for restoration and nursery development, seed provenance, genetic profiling and climate trajectories for different regions of Victoria. The establishment of climate future plots will (a) validate the 'climate readiness' of different provenances (identified through genetic and climate modelling), (b) act as seed production areas that provide climate ready sources of seed for future restoration projects (helping overcome the current risks of seed shortages), (c) identify how diverse ecological plantings influence faunal communities in different climatic landscapes, and (d) provide demonstration sites for the public and restoration industry. This presentation will outline the development of these guidelines and discuss how information from stakeholders, experts and practitioners nationally is being used to guide their development and implementation.

Notes:

Fire and landscape structure: Disentangling their effects on mammal communities and a threatened species

SIMEON ZYLINSKI†, MATTHEW SWAN, HOLLY SITTERS AND ALAN YORK

The University of Melbourne

†***Email**: szylinski@student.unimelb.edu.au*

Abstract

Habitat loss and fragmentation are key drivers of biodiversity declines and extinctions, and changes to the fire regime since European settlement are recognised as an additional threat to Australian fauna. There are key knowledge gaps regarding how species respond to contemporary fire regimes, especially where landscape structure has been altered by native vegetation loss. Planned fire is increasingly recognised as an important tool in conservation, as it directly benefits disturbance specialists and is useful for maintaining a mosaic of vegetation ages that provide a range of resources to support species diversity. However, fire and succession altering habitat suitability may also affect functional connectivity that is vital for gene flow and adaptability to environmental change. This project will answer questions about fire and landscape structure responses of ground-dwelling mammals in the central Mount Lofty Ranges, a region with a fine-scale fire mosaic within a fragmented landscape; these patterns may have an interacting effect on species but this is unknown. First, mammal community composition and species distributions will be related to landscape structure and past fire. Second, I will investigate the effects of fire regimes and landscape structure on the distribution and genetic connectivity of southern brown bandicoots, a key threatened species in the region. A landscape genetics approach will be used to examine bandicoot functional connectivity by relating habitat suitability across the landscape to evidence of gene flow. Finally, fire simulation modelling will predict how alternate fire regimes may affect the future distribution of bandicoots in the region. Results from this project will help clarify the effect of fire regimes on ground-dwelling mammals from a number of perspectives, and guide land managers in planned fire activities into the future.

Notes:

Fire regimes, resource availability and heath mouse abundance: untangling the web

RACHEL NALLIAH

The University of Melbourne

†***Email***: *rnalliah@student.unimelb.edu.au*

Abstract

Fire is a natural process in many parts of the world, although climate change and land management can result in inappropriate fire regimes and biodiversity loss. Fire influences fauna by changing the distribution and abundance of resources available to them. Many structural resources (such as litter and shrub cover) are reduced by fire, and then reaccumulate over time in the post-fire environment. Consequently, time since fire (TSF) is often used as a surrogate for resource availability and faunal abundance. However, the value of TSF as a surrogate is species-specific, and may vary spatially. Determining the inter-relationships between TSF, important structural resources and animal abundance is important for animal conservation in flammable ecosystems. The heath mouse (*Pseudomys shortridgei*) is an endangered critical weight range mammal. There are discrepancies and knowledge gaps regarding heath mouse habitat and fire age preference. Therefore, the objectives of this study are to quantify the relationship between heath mouse abundance and a) Time since fire and b) Resource availability, and to determine whether time since fire is a useful surrogate for resources important to heath mouse. Heath mouse will be trapped at 20 sites within treeless heathland of four fire age categories: recently burnt (0-3 years), early succession (4-9 years), mid succession (10-34 years) and late succession (35 + years). Habitat structure and floristic diversity will be measured at each site to quantify resource availability. The response of heath mouse abundance to TSF and structural and floristic resource availability will be analysed using generalised linear models (glm). The response of resources to time since fire will be analysed with linear models. Determining these relationships will aim to fill in the knowledge gaps associated with heath mouse. Furthermore, distinguishing the strength of TSF as a predictor of heath mouse abundance, will assist land managers in determining the effectiveness of TSF as a management tool when conserving heath mouse under the threat of climate change.

Notes:

Biogeographical and ecological insights from Australasian faunas: the megadiverse collembolan genus, *Entomobrya* (Entomobryidae)

RAFAEL JORDANA[1] AND PENELOPE GREENSLADE[2,3,†]

[1]*University of Navarra*
[2]*Federation University Australia*
[3]*Australian National University*

[†]***Email***: *p.greenslade@federation.edu.au*

Abstract

Australian Collembola belonging to the genus *Entomobrya* are common and widespread but have not been studied for 80 years. We are describing 38 new species all of which have not been found anywhere else making the Australian fauna the most species rich of any collembolan genus in Australia and highly endemic. Some species are only found on mountain tops and others in saline habitats that are at risk from climate change and rising sea levels respectively. None are found in arid and semi-arid regions nor on subantarctic islands. The five introduced exotic species are only found in pastures and on arable land and may be of economic significance. The ecological contribution these species make to ecosystem integrity is through their contribution to decomposition of plant residues and so recycling nutrients through the soil and leaf litter systems.

Notes:

Environmental factors affecting the germination and seedling emergence of two populations of an emerging agricultural weed; Wild lettuce (*Lactuca serriola*)

AAKANSHA CHADHA[1, †], SINGARAYER FLORENTINE[1], BHAGIRATH CHAUHAN[2], BENJAMIN LONG[1], MITHILA JAYASUNDERA[3], MUHAMMAD JAVAID[4] AND CHRISTOPHER TURVILLE

[1]*Federation University Australia*
[2]*The University of Queensland*
[3]*RMIT University*
[4]*University of Sargodha*

[†]***Email***: aakansha.chadha@gmail.com

Abstract

Wild lettuce (*Lactuca serriola* L.) has become a significant emerging agricultural and environmental weed in many countries. This invasive species is now naturalised in Australia and is claimed to cause significant losses within the agriculture industry. Compounding this problem, sustainable management of wild lettuce has been hampered by a lack of detailed knowledge of its seed ecology. In an endeavour to better understand this area, laboratory-based studies were carried out to examine whether there was any influence of certain environmental factors, including temperature and light conditions, salinity, pH, moisture availability and burial depth, on the germination and emergence of two spatially distant populations of wild lettuce. The result suggested that the germination of wild lettuce seeds took place across a broad range of temperature conditions (30/20°C, 25/15°C and 17/7°C) for both populations. It was also found that these seeds are non-photoblastic, as the germination was not affected by darkness, with greater than 80% germination observed in darkness for both the populations at all the tested temperature ranges. There was a significant decline in germination as conditions of salinity and osmotic stress increased for both the populations, but in neither of the populations was there any observed effect of pH on germination (above 80% germination in both the populations was exhibited in all tested pH ranges). However, our observations show that for both populations there is a significant decrease in germination as the burial depth increases. There is also a stark difference in the two populations with regard to the burial depth treatment, where seeds from the Tempy population had higher emergence when compared to the Werribee population for the 0.5cm burial depth. An important inference from these results for the management of this species, is that the incidence of seed germination, *vis-a-vis* the absence of light, indicates that light-reducing management techniques, such as mulching or using crop residues, will be unsuccessful for preventing germination of wild lettuce. By contrast, results indicate that burial of seeds at a depth of 4 cm or deeper will significantly reduce their emergence.

Notes:_____

Life in the suburbs: What is the impact of housing density and tree cover on urban bird communities?

JACINTA HUMPHREY[1,†], ANGIE HASLEM[1] AND ANDREW BENNETT[1,2]

[1]*La Trobe University*
[2]*Arthur-Rylah Institute*

[†]***Email***: *J.Humphrey@latrobe.edu.au*

Abstract

Increasing urbanisation is a global phenomenon which threatens native biodiversity and contributes to biotic homogenisation. Over the next 30 years, the global urban population is predicted to increase by two-thirds, resulting in the significant geographic expansion of cities. This issue is of particular concern in Australia, where 85% of the human population already reside in urbanised cities and towns. The process of urban development replaces native vegetation with artificial structures, impervious surfaces and high human population densities. Studies of urban bird communities to date have demonstrated that increasing housing density has a negative impact on avian species richness, and a positive impact on overall biomass and avian density. Along the development gradient, bird diversity is typically highest in areas of low housing density, located at the urban fringe. These peri-urban areas offer a range of novel anthropogenic resources to birdlife, including food, shelter and nesting sites, in addition to existing natural values. Peri-urban habitats are now under increasing pressure from expanding urban development. Such development has the potential to affect the distribution and abundance of individual species and the composition of communities. Knowledge of how urbanisation affects birdlife, and the properties of urban and peri-urban landscapes that increase the likelihood of species persisting, can assist in planning for more sustainable cities. This study investigates the influence of urban development on wildlife at the landscape-scale, by using avian communities around greater Melbourne as a case study. It is testing a series of hypotheses relating to the relative influence of housing density and the extent of tree cover of whole landscapes on avian species richness, community composition, and the occurrence of individual species. In this poster, we will present preliminary data collected during Spring 2018 and Autumn 2019.

Notes:

Influence of soil moisture regimes on growth, photosynthetic capacity, leaf biochemistry and reproductive capabilities of the invasive agronomic weed; *Lactuca serriola*

AAKANSHA CHADHA[1,†], SINGARAYER FLORENTINE[1], BHAGIRATH CHAUHAN[2], BENJAMIN LONG[1] AND MITHILA JAYASUNDERA[3]

[1]*Federation University Australia*
[2]*The University of Queensland*
[3]*RMIT University*

[†]***Email***: aakansha.chadha@gmail.com

Abstract

Global temperatures are predicted to increase by 1.5 - 5.9°C during this century, and this change is likely to impact average rainfall, with predictions that water deficit will perhaps be the most severe threat to sustainable agriculture. In this respect, invasive weeds, which have traits better adapted to drought stress than crops, add to concerns regarding crop sustainability. *Lactuca serriola,* an aggressive agronomic weed is thought to be a successful weed because of its ability to maintain high water use efficiency under drought conditions. In this study, experiments were conducted to examine the influence of different soil moisture regimes (100%, 75%, 50% and 25% water holding capacity (WHC)) on growth, photosynthetic capacity, leaf biochemistry and reproduction of this species. The highest plant height (115.14 cm ± 11.64), shoot diameter (9.4 mm ± 0.18), leaf area (1206.5 mm^2 ± 73.29), plant fresh weight (83.1 ± 3.98) and dry weight (22.38 ± 1.24) were recorded at 75% soil moisture content. A fundamental adaptation to drought was observed as plants in the 25% WHC treatment had the highest root:shoot ratio. It was noted that increases in soluble sugars and total phenolic content at 25% WHC as compared to 100% WHC was a response to water stress, as these biochemicals ameliorate the damaging effects of reactive oxygen species produced under stress conditions, and help plants regulate their physiological functions. Results also indicate that *L. serriola* can survive and produce seeds under water stress as more than 6000 seeds were produced per plant in all WHC treatments. In this study, there was no significant difference in the seed weight, number of seeds produced and their germination ability. This can have a huge impact on agricultural systems as the species can survive both under low and high soil moisture conditions, creating problems for farmers and agronomists. As a consequence, we suggest that the demonstrated ability of *L. serriola* to complete its life cycle and produce biomass and seeds under water stressed conditions leads to the introduction of strategies that minimize weed survival while maximizing irrigation efficiency for the crop.

Notes:_____

From baby boomers to generation alpha: Maintaining momentum in a multi-generational landscape change project

HELENA LINDORFF

Port Phillip and Westernport Catchment Management Authority

Email: Helena.lindorff@bigpond.com

Abstract

Over the decades, each generation has left a legacy of restoration works. The landscape tells a story of the challenges faced and some of the solutions that were employed. Old photo albums show the works of individuals and organisations, relics of plantations and concrete structures are evident in the landscape of a bygone era and anecdotes are passed down and shared amongst those that are keen to listen. This story would resonate with many communities all over Australia. *So how do we maintain the momentum in landscape restoration that requires the next generation to continue on the work?* Over the past decade, the Port Phillip and Westernport Catchment Management Authority, has facilitated a major project in the Upper Werribee Catchment, 70km west of Melbourne, called Grow West. The project was born from a ground swell of people in the late 1990s who felt that a coordinated approach was required to address some of the costly land degradation issues. Local groups and organisations were addressing these issues in an isolated manner; in a conventional way. The word 'collaboration' wasn't used or practiced well. The community saw that there had to be a better way forward if they were to make inroads with these issues. The word collaboration was put on the table, a vision was created and a project called Grow West was born. With its vision well on track with connecting large areas of public reserves; Brisbane Ranges National Park, Werribee Gorge State Park and the Lerderderg State Park, through a mosaic of restoration works on private property, one can report that the model and the mechanisms employed have helped the project flourish, continue to gain support within the community and NRM organisations and help it ride the highs and low of the fickle funding cycle.

Notes:

From participation to permanence? Exploring the progression of conservation landholder behaviours

MATHEW HARDY[1, †], VANESSA ADAMS[2], SARAH BEKESSY[1], BENJAMIN COOKE[2], ASHLEY DAYER[3], JAMES FITZSIMONS[4,5], WILL FORD[6], GEORGIA GARRARD[1], ALEXANDER KUSMANOFF[1], NICKI MUNRO[6] AND MATTHEW SELINSKE[1]

[1]RMIT University
[2]University of Tasmania
[3]Department of Fish and Wildlife Conservation
[4]The Nature Conservancy
[5]Deakin University
[6]Trust for Nature

[†]***Email**: mat.hardy@rmit.edu.au*

Abstract

Private land is home to important biodiversity and is a key part of Australia's conservation efforts. A variety of policy mechanisms exist aimed at encouraging landholders to conserve and manage their land in ways that are beneficial to biodiversity. Amongst these, permanent protection agreements (e.g. conservation covenants) offer binding, in-perpetuity restrictions on land-use and increased likelihood that management interventions will persist into the future, though the uptake of permanent agreements is often limited to landholders already engaged in conservation. Less-restrictive agreements, such as property registration and fixed-term agreements, are thought to help engage landholders reluctant to enter into permanent agreements, and might act as an 'entry point' for landholders into private land conservation. And over time, landholders could be using these agreements as 'stepping stones' towards permanent protection. However, whether landholders in these programs 'progress' from less-restrictive to permanent protection agreements has not been formally tested. We surveyed landholders in Victoria participating in either a voluntary property registration program or fixed-term incentive program, exploring their engagement in conservation and their willingness and ability to progress towards a permanent agreement. Respondents showed willingness and ability to progress to permanent protection, and to a lesser extent, engagement in conservation. Landholders intentions to progress to a permanent agreement were mixed, and many were uncertain. Survey responses indicated limited engagement from conservation agencies about the potential for progressing to permanent agreements. Increasing landholder knowledge about permanent agreements, and clarifying the pathways by which landholders can progress, may improve the uptake of permanent protection agreements.

Notes:

The effect of application timing for group B herbicides in herbicide tolerant Faba bean

AMALI WELGAMA[1, †], SINGARAYER FLORENTINE[1], JASON BRAND[2], TIM NIGUSSIE[2] , BHAGIRATH CHAUHAN[3], NIMESHA FERNANDO[1], MARTIN WESTBROOKE[1] AND CHRISTOPHER TURVILLE[1]

[1]Federation University Australia,
[2]Department of Jobs, Precincts & Regions,
[3]University of Queensland

[†]***Email***: amaliwelgama90@gmail.com

Abstract

The use of herbicides is the major method for controlling weeds in broad acre intensive farming systems. In faba beans, herbicide options are limited, particularly for the control of broadleaf weeds as the crop is sensitive to many of the herbicides that could kill or suppress the weeds. In cereals, Group B herbicides (ALS inhibitors) are commonly used to provide broad spectrum control of broadleaf weeds. In 2018, the first faba bean variety "PBA Bendoc" with tolerance to the Group B imidazolinone herbicides was released for Australian growers, providing alternative weed control options to improve reliability of farming systems. In this study, the tolerance of PBA Bendoc to the two herbicides, imazamox + imazapyr (24.75 + 11.25 gai/ha) and imazethapyr (70 gai/ha), applied either post sowing pre-emergent, 4 node, 8 node and flowering crop growth stage was compared to an intolerant variety PBA Samira under field conditions. Plant establishment, herbicide damage (HD) at 28 days after treatment (DAT), shoot and root biomass, crop height, weed populations, grain yield and harvest index were assessed at maturity. HD showed a significant difference with the growth stage where the damage was worst when applied at flowering. Imazamox + imazapyr caused more HD damage compared to imazethapyr in both varieties but Bendoc showed less damage than PBA Samira at all growth stages. No significant yield loss for both varieties at PSPE, 4N and 8N, however significant yield loss for Samira at flowering application. Due to improved weed control, PBA Bendoc showed a slight yield increase. However, regardless of the application timing, the root biomass was higher in Samira. In conclusion, PBA Bendoc has good tolerance at a range of application timings where an improved weed control is also likely to enhance grain yield. The very dry seasonal conditions that prevailed at the time of the trial may have influenced the results.

Notes:

Development of genetic primers for Australian native frogs to assist field detection using environmental DNA (eDNA)

JACINTA RICHARDSON[1,†], ASHLEY OLSON[1], STELLA LOKE[2] AND MEAGAN DEWAR[1,2]

[1]*Federation University Australia*
[2]*Deakin University*

[†]***Email***: jacintarichardson@students.federation.edu.au

Abstract

Frogs play a critical role in ecosystem functioning. In recent decades, frog populations around the world have suffered massive declines and frogs have become one of the most threatened taxa on the planet, requiring urgent conservation action. Environmental DNA (eDNA) has emerged as a useful tool for monitoring frog populations, with many advantages over traditional monitoring techniques. However, eDNA monitoring requires the use of genetic primers, which enable researchers to differentiate between species living in sympatry. The application of eDNA methods to studies of Australian frogs is currently limited by a lack of suitable primers and, thus, primer development represents a significant contribution to conservation biology. This project will use polymerase chain reaction (PCR) and next-generation sequencing (NGS) to test the suitability of existing primers for detecting a variety of Australian native frogs. It is expected that most will be ineffective for Australian species and therefore newly designed, species-specific primers will be developed. This project will increase the number of Australian frog species that can be detected from environmental samples, extending the application of eDNA to field detection of Australia frogs. Primer development will expand our knowledge of species distributions and improve conservation measures.

Notes:

Elevated CO_2 and drought modify the Pyrrolizidine alkaloids content in the arid-zone invasive species *Heliotropium europaeum*

NIMESHA FERNANDO†, SINGARAYER FLORENTINE AND BEN LONG

Federation University Australia

†***Email**: n.jayaweera@federation.edu.au*

Abstract

Common heliotrope *(Heliotropium europaeum* L.) is an arid-zone invasive, summer-growing annual herb that poses a significant threat to the productivity and economic security of Australia's agricultural systems. It contains hepatotoxic pyrrolizidine alkaloids (PA), which are known to induce chronic toxicity that can result in severe illness or death to livestock, with pigs, poultry and cattle being particularly sensitive. Common heliotrope is one of the emerging troublesome weeds in Australian cropping and pasture systems; predicted climate change impact on its PA production has not yet been studied. To test the hypothesis that increasing atmospheric CO_2 concentration and drought impact on PA content of common heliotrope, we grew common heliotrope in CO_2 growth chambers. The experimental design was factorial with two [CO_2] (ambient CO_2 concentration: 400±10 ppm: a[CO_2] *vs* elevated atmospheric CO_2 concentration: 700±10 ppm: e[CO_2]), two soil water regimes (80% field capacity and drought during DC 60; heading stage) with eight replicates. Plants were harvested at the flowering stage and alkaloids were extracted. Heliotrine and lasiocarpine content were quantified using HPLC-MS. It was found that heliotrine concentration was significantly increased (+21%, p=0.05) in plants grown under e[CO_2] than a[CO_2] grown plants. The water regime × [CO_2] interaction was seen to be significant for lasiocarpine concentration of Common heliotrope: lasiocarpine concentrations were higher (+52%, p=0.005) in plants grown under well-watered conditions than drought-stressed plants under e[CO_2]. Overall, lasiocarpine concentration in Common heliotrope was lower (-27%, p=0.005) in drought-stressed plants than well-watered plants. As Common heliotrope is one of the important emerging weeds in agriculture systems in Australia, the risk of contaminating grains with this species will increase, and in particular its effect on honey production will be higher in near future. Higher heliotrine concentration in Common heliotrope under e[CO_2] may further increase the threat of ingestion of PA by livestock and humans, through contamination of harvested material.

Notes:

Environmental factors effecting the germination and seedling emergence of two populations of an aggressive agricultural weed; *Nassella trichotoma*

TALIA HUMPHRIES[1,†], BHAGIRATH CHAUHAN[2] AND SINGARAYER FLORENTINE[1]

[1]*Federation University Australia*
[2]*The University of Queensland*

[†]***Email:*** *taliahumphries@students.federation.edu.au*

Abstract

Nassella trichotoma (Nees) Hack. ex Arechav. (Serrated tussock) is an aggressive globally significant weed to agricultural and natural ecosystems. Herbicide resistant populations of this C_3 perennial weed have emerged, increasing the need for effective wide-scale cultural control strategies. A thorough seed ecology study on two spatially distinct populations of *N. trichotoma* was conducted to identify differences in important environmental factors (drought, salinity, alternating temperature, photoperiod, burial depth, soil pH, artificial seed aging, and radiant heat) which influence seed dormancy. Seeds were collected from two spatially distinct populations; Gnarwarre and Ingliston in December 2016 and February 2017, respectively. Twenty sterilized seeds were placed into Petri dishes lined with a single Whatman® No. 10 filter paper dampened with the relevant treatments solution and then incubated under the identified optimal alternating temperature and photoperiod regime of 25℃/ 15℃ (light/dark, 12h/12h). For the burial depth treatment, 20 seeds were placed into plastic containers (10cm in diameter and 6cm in depth) and buried to the relevant depth in sterilized soil. All trials were monitored for 30 days and germination was indicated by 5mm exposure of the radicle and emergence was indicated by the exposure of the cotyledon. Each treatment had three replicates for each population, and each treatment was repeated to give a total of six replicates per treatment, per population. *Nassella trichotoma* was identified to be non-photoblastic, with germination (%) being similar under alternating light and dark and complete darkness conditions. With an increase of osmotic potential and salinity, a significant decline in germination was observed. There was no effect of pH on germination. Exposure to a radiant heat of 120℃ for 9 minutes resulted in the lowest germination in the Ingliston population (33%) and the Gnarwarre population (60%). In the burial depth treatment, the Ingliston population and the Gnarwarre population had highest emergence of 75% and 80%, respectively at a depth of 1cm. Variation between the two populations was observed for the burial depth treatments; Gnarwarre had greater emergence than Ingliston depth, while Ingliston had greater emergence at the soil surface than Gnarwarre. The Gnarwarre population had greater overall germination than Ingliston, which could be attributed to the greater seed mass (0.86mg compared to 0.76mg, respectively). This study identifies that spatial variations in *N. trichotoma's* seed ecology are present between spatially distinct populations.

Notes:

Restoration of a degraded grassland by targeting the dominant weed; a case study using Serrated tussock

TALIA HUMPHRIES†, SINGARAYER FLORENTINE, KIM DOWLING AND CHRISTOPHER TURVILLE

Federation University Australia

†***Email*:** *taliahumphries@students.federation.edu.au*

Abstract

Serrated tussock is one of the worst weeds for reducing biodiversity and carrying capacity in south-eastern Australia, New Zealand and South Africa. A variety of control methods have been attempted to control this weed, including herbicide, establishing completion, fencing, grazing, biological control, and altering soil dynamics. Currently the most effective control method is the residual herbicide flupropanate, however herbicide resistant populations have emerged in Victoria, encouraging the development of integrated control methods. The objectives of this project are to i) identify individual and integrated effectiveness of applying 12 different treatments; herbicide, fire, spot spraying, shallow tillage, fencing and broadcasting native seeds, in order to reduce the soil seedbank, plant density and seedling recruitment of Serrated tussock, and ii) to observe if reducing the dominant weed (Serrated tussock) within a degraded grassland can promote grassland restoration. The study was conducted at Little Raven North, Little River, Victoria, and is dominated by invasive plants, particularly Serrated tussock. Each of the 13 treatments (the 12 treatments plus a control) had six replicates, giving a total of 78 10X10m plots. The above ground vegetation was recorded using five equally spaced transect lines, and data was collected every 0.5m. To survey the seedbank, four soil cores were collected and combined from each plot and transported to the glasshouse at Federation University Australia, Mt Helen. Soil was air dried and then weighed and placed into plastic punnets and emerging seedlings were identified and removed weekly. Data was collected pre-treatment, and again after the spraying, fencing and fire treatments had been implemented. Photos show the fire treatment substantially reduced the above ground biomass of Serrated tussock compared to the unburnt plots. This project will be monitored for a further two years to identify the long-term benefits of these integrated management techniques on the restoration of a degraded grassland.

Notes:

The effect of moisture stress and elevated carbon dioxide on the biomass and reproductive capacity of two *Salvia verbenaca* cultivars (*verbenaca* and *vernalis*)

SANDRA WELLER[1, †], SINGARAYER FLORENTINE[1] AND MANSOOR JAVAID[2]

[1]*Federation University Australia*
[2]*University of Sargodha*

[†]***Email**: s.weller@ballarat.edu.au*

Abstract

Climate change is the most serious threat to agriculture today. It has been predicted that it will result in more frequent drought, which will negatively affect many primary producers. However, some researchers have concluded that elevated atmospheric carbon dioxide may increase plant biomass of some species, including weeds. This may pose a serious problem for land managers, since larger and more robust weeds may require greater effort and expense for removal. Two cultivars of *Salvia verbenaca* (wild sage) were investigated for their responses according to nine biomass parameters (plant height, stem diameter, number of leaves, number of branches, leaf area per plant, leaf thickness, root and shoot dry matter, dry weight of leaves per plant) and two fecundity parameters (100 seed weight and number of seeds per plant). The plants were grown under well-watered and drought conditions, in ambient (400 ppm) and elevated (700 ppm) carbon dioxide. Both varieties showed a variation of response to each of the water regimes and atmospheric carbon dioxide conditions. Drought reduced all of the biomass parameters in both species, but elevated carbon dioxide tended to increase biomass, even under drought conditions. However, the magnitude of response was not uniform across all parameters for each cultivar. Overall, fecundity was reduced by drought, since there was a decline in numbers of seeds, although elevated carbon dioxide slightly increased seed weight in one of the cultivars. But unlike the biomass response, there was almost no change of seed production in the elevated carbon dioxide treatments. The results of this research can be used to predict how these weeds may impact agriculture in future, and thereby provide support for continuing efforts to prevent new weed outbreaks of this species, as well as efforts to reduce the impacts from existing populations.

Notes:

Effect of moisture stress, elevated carbon dioxide and herbicide application on windmill grass (*Chloris truncata*)

SANDRA WELLER[1, †], SINGARAYER FLORENTINE[1] AND BHAGIRATH CHAUHAN[2]

[1]*Federation University Australia*
[2]*The University of Queensland*

[†]***Email**: s.weller@ballarat.edu.au*

Abstract

Chloris truncata, windmill grass, is an Australian native C4 (warm season) grass that has become a summer fallow weed of no-till agriculture. Recently, this species has begun to show resistance to glyphosate. To investigate the role of drought and increased atmospheric carbon dioxide on this process, three trials using plants grown from glyphosate-resistant and glyphosate-susceptible *C. truncata* seeds were conducted. The first two trials investigated the impact on plant survival and biomass production when herbicides were applied under conditions of; (1) moisture stress and (2) elevated carbon dioxide. The third trial investigated the effect of moisture stress and elevated carbon dioxide exposure on plant growth and fecundity (seed production). The first two trials indicated that both moisture stress and exposure to elevated carbon dioxide reduced the effectiveness of herbicides, although herbicide application did reduce plant biomass according to dose. In the third trial, biomass and seed productivity varied slightly between each plant type. Although the glyphosate-resistant plants grew faster and produced more leaves initially, by the end of the experiment the glyphosate-susceptible plants had produced more biomass and more seeds. Alerting land holders to the probability of plant survival following herbicide application under drought conditions should be prioritized, so that other methods or more appropriate herbicides can be applied under these conditions. It is also apparent that developing resistance to herbicides comes at a cost to plant fitness, since the glyphosate-susceptible plants were ultimately more successful than the glyphosate-resistant at the end of their respective life cycles. In a circumstance where both of these types are present, but no herbicide is used, it can be expected that the susceptible type might outcompete the resistant over time, thereby replacing it. However, more research is required to define the long-term trajectory of these two types under future climate change scenarios.

Notes:

Monitoring a Bat Maternity Cave in South-eastern Australia Using Remote Technology

YVONNE INGEME[1,3,†], AMANDA BUSH[2], LINDY LUMSDEN[2] AND RETO ZOLLINGER[3]

[1]Department of Environment, Land Water and Planning
[2]Arthur Rylah Institute
[3]Victorian Speleological Association

Email: yvonnereto@hotmail.com

Abstract

The Critically Endangered Southern Bent-wing Bat (SBWB) *Miniopterus orianae bassanii* is restricted to south-eastern Australia, where its numbers have declined significantly in recent decades. It is an obligate cave-dwelling bat with two known key maternity caves, one in south-western Victoria and the other in south-eastern South Australia. Little is known about what makes these caves suitable as maternity sites or how microclimate, seasonal conditions and environmental triggers influence the SBWB breeding cycle. This information is critical to effectively manage the bats and their cave environment. In addition to monitoring the bat population using bat detectors, which sample relative activity every night, more detailed data is now being collected using three remote, covert, infrared, time-lapse cameras in one of the birthing chambers, taking a photograph every hour, and two temperature and humidity dataloggers (Hydrochron ibuttons) collecting hourly microclimatic data. The bat detector, infrared camera and dataloggers can remain in place for up to 4 months between battery changes, enabling long term sampling. The Victorian maternity cave has several entrances that allow air to circulate. One of the birthing chambers is within a bell hole approximately two metres above the cave floor. The infrared cameras reveal highly synchronised birthing patterns. In 2015, the first pups were born on 2nd December, the main birthing commenced in the early hours of the 3rd with the majority of pups born by the 4th. Females then transferred their pups to another bell hole within a larger (40 m high) more open chamber by the 8th December 2015. The temperature and humidity dataloggers revealed how and when the bats modified their microclimatic environment, while the cameras provided detailed corresponding information on the number of bats in this bell hole. Data collected over a four month period indicate that while adult bats are clustering within the birthing chamber they increase the temperature around the pups by up to 17.0°C above ambient cave temperature, to a maximum of 33.1°C. They also influence humidity by lowering RH from 99.6 within the cave to a minimum of 72.8 around the pups. The remote cameras and dataloggers show great promise as non-invasive techniques enabling detailed, hourly monitoring of bat numbers and their behaviour, as well as the microclimatic conditions within their roosts, with minimal disturbance to the bats.

Notes:_____

Tying it all together: building spatial data structures for best-practice natural resource management in the Victorian context

GARETH DAVIES

Central Highlands Water

***Email**: gareth.davies@chw.net.au*

Abstract

Effective natural resource management requires good information. For land and natural resource managers working in organisations with remits which extend beyond NRM, it can be a great challenge to build information systems which meet internal reporting and compliance requirements while also ensuring that best-practice adaptive management approaches and interagency collaboration are supported. The Biodiversity 2037 plan developed by the State of Victoria Department of Environment, Land, Water & Planning (DELWP) appears to represent an adoption of the Output Data Standards for monitoring, evaluation and reporting, developed by DELWP in conjunction with the Catchment Management Authorities, for industry-wide reporting of biodiversity-related activities. The Output Data Standards themselves incorporate elements of the Conservation Measures Partnership's Open Standards for the Practice of Conservation, particularly in their intended support for the adaptive management framework. This framework is understood to represent current operational best-practice within the natural resource management industry. This poster will outline proposed data structures for the capture of information about natural resources in enterprise asset management (EAM) and geographical information systems (GIS) environments. These data structures take the form of an 'Environmental Assets' geodatabase for the recording of information about the location, extent and condition of extant natural resources and associated management infrastructure in a structure consistent with internal EAM processes and reporting requirements, an 'Observations and Hazards' geodatabase for field-based recording of monitoring data, ad-hoc observations, and the reporting of environmental hazards, and an 'Activities' geodatabase representing a localised implementation of DELWP's Output Data Standards. Together, these data structures comprise an information system which permits compliance with engineering-oriented asset management processes, ease of use for land and natural resource managers with remote field-based data collection possible via mobile device, implementation of the adaptive management framework, and facilitating interagency collaboration.

Notes:

Exploring the link between environmental water and the climate

SARAH TREBY†, PAUL CARNELL, STACEY TREVATHAN-TACKETT, GIUDITTA BONETTI AND PETER MACREADIE

Deakin University

†***Email***: *sarah.treby@deakin.edu.au*

Abstract

Wetlands are among the world's most efficient natural carbon (C) sinks, sequestering atmospheric CO_2 through high plant productivity and storing in long term in soils. Wetland restoration has been identified by the IPCC as an important mitigation tool against climate change. However, when inundated, wetlands are also high natural sources of methane (CH_4), and depending on a wide range of environmental variables, CH_4 emissions can be high enough to shift wetlands from being net C sinks to net C sources. In Australia, land use change and river regulation have led to substantial loss of wetlands. To overcome this loss and restore biodiversity, environmental water ('eWater') aims to return an allocation of irrigation water from the Murray Darling Basin back to streams and wetlands each year. We were interested in the impact of environmental water delivery on the greenhouse gas emissions of wetlands, to consider potential management trade-offs between carbon processes and biodiversity gains. We monitored a billabong wetland fed by the Wakool River (a tributary of the Murray River) in the Riverina region of NSW over a 2-week period to include before, during, and after water delivery. Both CO_2 and CH_4 were measured 12 times each day and night. Results showed that CO_2 decreased following delivery, while CH_4 increased. Overall, total emissions (calculated using the potency and lifespan of each gas) were reduced after watering. The impact of this study for land managers is that eWater may be used to achieve multiple outcomes without a management trade-off. eWater delivery might be considered for carbon offsetting initiatives, however more research monitoring the entire watering cycle (e.g. drawdown and dry), and multiple wetland types, i.e. with differing soils, vegetation, and geomorphology, is necessary.

Notes:

Frog Court Wetland Upgrade

ANGELA GANLEY

Hume City Council
Email: AngelaG@hume.vic.gov.au

Abstract

Frog Court Wetland is an existing wetland in Craigieburn that treats an upstream industrial catchment and discharges immediately to Merri Creek. This wetland was reset in 2018 to meet a number of WSUD and ecological objectives. Previous investigations had identified that the Frog Court Wetland was serving no stormwater treatment function. This was due to design and construction issues resulting in a high normal water level which flooded out the GPT, caused bypass of almost all flows when rainfall occurred and reduced the capacity of the upstream pipe system, causing localised flooding issues. Non-compliance of some batters with current safety standards also meant that the site could not be maintained safely and could not be made publically accessible. The wetland was known to provide habitat for the *Environmental Protection and Biodiversity Conservation* Act (1999) listed Growling Grass Frog (*Litoria raniformis)*. Research had indicated that breeding of the Growling Grass Frog within Frog Court Wetland had been declining over a number of years. A report commissioned by the Department of Environment, Land, Water and Planning (DELWP) recommended resetting and desilting the Frog Court Wetland to support the viability of the Merri Creek Growling Grass Frog metapopulation. The wetland remediation was designed to achieve stormwater capacity, stormwater pollutant reduction and public safety requirements under Melbourne Water Corporation's *Wetland Design Manual* (2016). In addition, the project was the first to incorporate DELWP's *Growling Grass Frog Habitat Design Standards (2017).* The design includes:

- A series of deep water ponds, up to 1.5m deep, to support submergent and floating vegetation and to prevent the wetland from being choked by reeds and bulrushes
- Rock beaching to reduce Chytrid Fungus
- Additional instream vegetation suited to the Growling Grass Frog
- Improved water quality, and
- A penstock valve on the outlet structure to help control Gambusia and assist with wetland maintenance.

Frog Court Wetland is an innovative case study in regard to meeting separate wetland objectives and will provide ongoing learnings for the stormwater industry and for threatened frog conservation.

Notes:

Nature Stewards©: Building communities' connection with nature and the next generation of environmental volunteers

MADELAINE WILLCOCK[1], ANN MCGREGOR[2], BRUCE MCGREGOR[2] AND ANDREW KNIGHT[2]

[1]Outdoors Victoria, Nature Stewards Program
[2]Nature Stewards Program Advisory Group

†*Email*: naturestewards@outdoorsvictoria.org.au

Abstract

Our increasing disconnection from nature presents a significant challenge for individual wellbeing, community health and cohesion, and environmental health. The Nature Stewards© program provides an engaging introductory environmental curriculum covering knowledge of the Victorian and local environment, with opportunities to learn from local Indigenous communities, and ways to get involved in environmental volunteering. This ten-week community program supports individual wellbeing through shared time in the natural environment, builds confidence to be in and take action for nature, and strengthens environmental literacy. Nature Stewards is a unique collaboration between Outdoors Victoria, Parks Victoria, Field Naturalists Club of Victoria, Victorian National Parks Association, and many other individuals and organisations, supported and funded by DELWP and the Cities of Melbourne and Melton. Nature Stewards has delivered impact to the community right from its demonstration phase, in 2019 in the cities of Melbourne and Melton, it has been shown to promote greater emotional and physical connection with nature, positive behaviour changes towards or starting environmental volunteering, increased wellbeing and local ecological knowledge. This program is directly tackling the challenge of nature disconnection and building a new cohort of environmental volunteers, by offering a positive and inclusive program to learn, meet others, get involved, and connect with nature.

Notes:

Breeding system and population genetics of a rare shrub *Grevillea bedggoodiana* (Enfield Grevillea)

STANISLAW WAWRZYCZEK

La Trobe University

Email: 18100883@students.latrobe.edu.au

Abstract

Narrowly endemic species are considered vulnerable to extinction because of their generally low evolutionary potential – that is, the ability to evolve and adapt to changing environments. The evolutionary potential is a function of fecundity and genetic diversity, but also population size and connectivity. All of these factors, therefore, need to be considered when setting conservation priorities. However, the reproductive biology of many of the Australian plant species remains poorly known and some of the narrow endemics can maintain high levels of genetic diversity. Grevillea is a large, nearly exclusively Australian genus of plants including many rare and threatened species. *Grevillea bedggoodiana* (Enfield Grevillea) is a narrowly endemic shrub occurring only in Enfield State Forest in Victoria, 25 km south of Ballarat. It has been nominated for listing under the Flora and Fauna Guarantee Act, however, currently nothing is known of its breeding and population genetics. This study investigated the breeding system of *Grevillea bedggoodiana*, and assessed genetic diversity and structure of its populations in Enfield State Park. The species was found to be self-compatible but strongly and preferentially outcrossing. Inbreeding was very low (F -0.042 – 0.015, mean -0.013) and there was no evidence of pollen limitation of seed set. Microsatellite analysis found genetic diversity of the six sampled populations to be high (He 0.624 – 0.776, mean 0.733, allelic richness 4.95 – 6.74, mean 6.02, min. n = 10). All populations maintained private alleles (mean Apriv = 2.8), but were fairly well connected, despite some structure (AMOVA: 8% of variance due to between-populations differentiation, Fst = 0.081). Management should maintain connectivity between the populations and mitigate extrinsic risks, especially the spread of *Phytophthora cinnamomi*.

Notes: