APCC11

11th Australasian Plant Conservation Conference 2016

11th Australasian Plant Conservation Conference

"New Approaches to Plant Conservation Challenges in the Modern World"

Conference Program & Abstracts

Monday 14th November – Friday 18th November 2016
Royal Botanic Gardens Victoria, Melbourne

ROYAL BOTANIC GARDENS VICTORIA

Australian Network for Plant Conservation Inc

LA TROBE UNIVERSITY

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11th Australasian Plant Conservation Conference
14 November to 18 November 2016
Royal Botanic Gardens Victoria, Melbourne

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AUSTRALIAN NATIONAL BOTANIC GARDENS

Front Cover : Photo credits

Sclerolaena napiformis growing beside the Campaspe River north of Rochester in north central Victoria. (D. Cook, Rakali Consulting)

Spyridium furculentum growing at the RBGV, Melbourne. (J. Lynch)

Pomaderris vacciniifolia flowers. (S. Meacher)

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Additional Organisational Support

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Welcome from the Australian Network for Plant Conservation Inc.

Welcome to the Australian Network for Plant Conservation's (ANPC) **11th Australasian Plant Conservation Conference 2016.**

This is the ANPC's twenty fifth year of promoting and working for plant conservation in Australia. The ANPC is a not-for-profit non-government organisation, founded in 1991 from the first national conference convened by the Australian National Botanic Gardens. Our mission is "To promote and develop plant conservation in Australia". We do this through providing a forum for the exchange of information and ideas and providing a connection between plant conservation scientists and practitioners. We publish findings from current research and on-ground practice, plant conservation techniques and technical guidelines as well as the quarterly bulletin Australasian Plant Conservation. We hold plant conservation workshops and promote an ecological focus in on-ground conservation, rehabilitation and management of remnant vegetation, threatened plants and ecological communities. We also hold this National Conference every 2 years addressing a broad range of key plant conservation issues, bringing together conservation scientists and practitioners from around Australia.

The theme for this conference is "New Approaches to Plant Conservation Challenges in the Modern World". Together we will explore existing approaches to plant conservation across Australia, highlighting significant achievements and evaluating our current approaches. The conference is also providing an important opportunity to explore what are the major challenges Australian plants will be facing in the next few decades, and to identify new directions and approaches that will be required if we are to continue to conserve our unique floral heritage. The conference is bringing together a diverse range of participants including landholders, land managers, research scientists, students and practitioners from an equally diverse range of organisations including universities and other research organisations, CMAs and State-based management agencies and NGOs.

Changing climates and extensive habitat degradation continue to challenge many plant species. Being at the leading edge of this change, we will be held to account by future generations of Australians should we not do everything possible to arrest and reverse species decline. Developing the logistical and technological capacity to ensure that we have sufficient high quality seed for species restoration and understanding how to best use mutualistic organisms will undoubtedly improve our capacity to recover and conserve plant species. Perhaps a more significant challenge is how to reconnect Australians with our many wonderful and unique plants, and developing conservation approaches that maximise the benefits for people and plants are required to do this successfully. By exploring the frontiers of Australian plant conservation through new and emerging ideas we will begin developing adaptive approaches to conservation that will be necessary to respond to future challenges.

On behalf of the ANPC I'd like to thank the major conference sponsors who have helped make this event possible: in particular La Trobe University, Royal Botanic Gardens Victoria, the Australian National Botanic Gardens, The Rural Industries Research and Development Corporation, Eucalypt Australia, Ecology Australia, the Australian Plant Society Victoria, Parks Victoria, Flora Victoria and Brimbank City Council, as well as our minor sponsors Ecology and Heritage Partners, Earth Welfare Foundation, CSIRO and Undercover Landcare. These organisations have recognised the value of supporting the ANPC in facilitating communication and networking among scientists, land managers, community groups, government and industry for improved flora conservation in Australia.

This is going to be an excellent conference and on behalf of the entire ANPC membership I would like to thank the conference organising committee, especially John Morgan, Ben Zeeman, Susan Hoebee, Trevor Edwards and Susanna Venn from La Trobe University, David Cantrill from the Royal Botanic Gardens Victoria, ANPC Committee members Paul Gibson-Roy and David Coates, Karina Salmon from Biosis, and ANPC staff and volunteers Jo Lynch, Martin Driver, Carly Westbye, Merryl Bradley and Jenny Michelle. They have worked tirelessly to ensure that this conference will be a success and more importantly that the findings from the conference are translated into successful flora conservation initiatives and outcomes.

The ANPC is a membership based organisation with a diverse range of members including scientists, land managers, State and Commonwealth Departments, industry, the volunteer conservation movement and the broader community. Membership fees are an essential part of our financial base, and members and member-organisations are the lifeblood of our network. If you are not already a member, we would like to encourage you to join for 2017 – special APCC11 discount membership forms are available in your delegate bags.

Linda Broadhurst
President
Australian Network for Plant Conservation Inc.

APCC11 session themes

1. Assisted colonisation as a practical tool for climate change mitigation

One of the relatively new tools in the conservation toolbox is assisted colonisation—broadly defined by the IUCN as the movement of an organism outside of its native range to avoid extinction of populations due to current or future threats. The question of whether assisted colonisation should even be considered as an option has spawned a lively debate but the reality is that assisted colonisation is already being used, and is gaining in acceptance as a tool. This theme will explore examples of assisted colonisation, and consider the pitfalls and successes of the method.

2. Conservation for people and nature: how do we maximise the benefits for both?

Conservation has always been about how people view, value and use nature. There is concern amongst conservationists that people are taking fewer opportunities to experience and connect with nature, despite its obvious benefits. It is likely that conservation projects work best when they involve nearby communities, and people benefit as much as the species that share the local environment. But how can this be done? In this theme, we will explore examples where people, and nature, benefit when conservation works are targeted with both in mind.

3. Rethinking landscape restoration: seed production, provenance, conservation planning

An increased understanding of the future impacts of climate change has changed the way many think about ecological restoration. It brings into question the utility of historical benchmarks as restoration targets, the species or seed sources to be used, and the time frame for planning. Because the scale of restoration needed to recover landscapes is so large, it also highlights that innovative approaches to producing seed (outside of wild populations) will be imperative. This theme aims to explore new perspectives on seed production, provenance and restoration planning with a view to the long-term and questions such as: what are we restoring?

4. Holistic conservation: the role of mutualisms in ensuring functional ecosystem recovery (eg. pollinators, soils).

A mutualism, in its broadest sense, is the way that two species exist in a relationship in which each benefits from the activity of the other. While the concept is not new, it's not always been at the forefront when planning for functional landscape recovery. For example, re-introducing a plant species dependent on a pollinator mutualism to a landscape will be doomed if the pollinator is missing. The introduction of threatened orchids to sites where the species once occurred may fail if the soil biota it depends upon has also been lost. In this theme, we want to highlight examples of plant conservation works that look to recover a species with mutualisms in mind.

5. Rescuing small populations from extinction

Genetic rescue is one of the tools gaining traction in the plant conservation field to save small populations from extinction. Genetic rescue is the process where small inbred populations receive genes from another population such that their overall genetic diversity increases. A suite of studies from the past decade highlights the value of genetic rescue but it has not been widely applied to conserve threatened populations. There are many reasons given for not attempting genetic rescue but in this theme, we want to highlight the ways in which genetic rescue can be applied. How would it be undertaken? On what species? Should we be worried, or emboldened?

6. New challenges, emerging ideas

In this theme, we hope to identify the new challenges to plant conservation that have barely even been registered yet. The rise of pathogens might be one. We also want to highlight new ideas in plant conservation that deserve our consideration, but remain largely speculative or data poor. This theme is an exciting opportunity to showcase these ideas.

Conference Program

MONDAY 14TH NOVEMBER 2016

4:00 – 6:00pm	Early Registration @ Domain House
5:00 – 7:30pm	The ***Spyridium furculentum*** **WELCOME RECEPTION** @ Domain House. Stand up drinks and canapés
6:30pm	Welcome Address by **Tim Entwisle** Director and Chief Executive, Royal Botanic Gardens Victoria

TUESDAY 15TH NOVEMBER 2016

8:00 – 8:50am	Registration @ Domain House
8:50 – 10:25am	Mueller Hall, National Herbarium of Victoria
8:50 – 9:00am	Welcome to Country - Boon Wurrung Foundation
9:00 – 9:10am	Welcome to Conference / Housekeeping **John Morgan** - Chair, APCC11 Organising Committee
9:10 – 9:30am	ANPC Presidential Address **Linda Broadhurst** – President, Australian Network for Plant Conservation
9:30 – 9:35am	Welcome to the Royal Botanic Gardens Victoria **Tim Entwisle** (Director and Chief Executive, Royal Botanic Gardens Victoria)
9:35 – 10:15am	The *Melaleuca wimmerensis* KEYNOTE ADDRESS **Gregory Andrews** (Commonwealth Threatened Species Commissioner) 'The Australian Government's Threatened Species Strategy and the 30 plants we will save from extinction' **Chair: Tim Entwisle** (Royal Botanic Gardens Victoria)
10:15 – 10:20am	Questions
10:20 – 10:25am	Sponsorship Address - **Bram Mason** (Eucalypt Australia, VIC)
10:25 – 10:55am	**MORNING TEA @ Domain House** sponsored by Eucalypt Australia
10:55 – 11:35am	**PLENARY LECTURE 1: Jen Silcock** (University of Queensland, QLD) 'Lost in the desert or Red Hot? A botanical tour around Australia, beginning on the Paroo River.' **Chair: John Morgan** (La Trobe University)

The *Ballantinia antipoda* session:	**RESCUING SMALL POPULATIONS FROM EXTINCTION** **Chair: Matt Dell** (Ecology Australia)
11:35 – 11:50am	**David Coates** (Department of Parks & Wildlife, WA) 'Extinction debt and the conservation of small isolated populations of rare and threatened plants in south west Western Australia'
11:50 – 12:05pm	**John Patykowski** (Deakin University, VIC) 'Germination ecology, seed dispersal, and decline in a critically endangered plant: A case study of *Pomaderris vacciniifolia* (Round-Leaf Pomaderris)'
12:05 – 12:20pm	**Paul Foreman** (Blue Devil Consulting, VIC) 'Ballantinia's road to recovery: Restoring the hydrology of a key population'
12:20 – 12:35pm	**Geoff Carr** (Ecology Australia, VIC) 'Undocumented diversity masks conservation status and threats in Correa (Rutaceae)'
12:35 – 12:50pm	**Brian Bainbridge** (Merri Creek Management Committee, VIC) 'Genetic rescue of the Plains Yam Daisy *(Microseris scapigera)* on the Merri Creek'

12.50 – 1.50pm	**LUNCH @ Domain House** sponsored by Australian Plants Society Maroondah Group
12.50 – 1.50pm	**ANPC 2016 ANNUAL GENERAL MEETING** @ Domain House
1:50 – 2:30pm	**PLENARY LECTURE 2: Paul Gibson-Roy** (Greening Australia, NSW) 'An Australian's first hand observations of the US seed production and restoration sectors' **Chair: Martin Driver** (ANPC)

The *Acacia enterocarpa* session:	**RETHINKING LANDSCAPE RESTORATION: SEED PRODUCTION, PROVENANCE, CONSERVATION PLANNING** **Chair: Paul Adam** (University of NSW)
2:30 – 2:45pm	**Melissa Millar** (Department of Parks & Wildlife, WA) 'An integrated approach to designing provenance guidelines illustrated for landscape restoration in the Midwest of Western Australia'
2:45 – 3:00pm	**Jim Begley** (Goulburn Broken Catchment Authority, VIC) 'Seed production practice for a changing climate'
3:00 – 3:15pm	**Elisa Raulings** (Greening Australia, VIC) 'Planning the restoration of wetlands - where should we work?'

3:15 – 3:45pm	**AFTERNOON TEA @Domain House** sponsored by Eucalypt Australia

The *Brachyscome walshii* session:	**RETHINKING LANDSCAPE RESTORATION: SEED PRODUCTION, PROVENANCE, CONSERVATION PLANNING** **Chair: Karina Salmon** (Biosis)
3:45 – 4:00pm	**John Morgan** (La Trobe University, VIC) 'Targeting the timing of fire to restore ecosystem structure and function'
4:00 – 4:15pm	**Maurizio Rossetto** (Royal Botanic Gardens & Domain Trust, NSW) 'Restore & Renew: An innovative landscape-wide, multispecies project'
4:15 – 4:30pm	**Nic McCaffrey** (WSP Parsons Brinckerhoff/The University of Queensland, QLD) 'Post-mined landscapes aren't the Garden of Eden: Approaches for determining reference sites where ecosystem replacement is not the aim'
4:30 – 4:45pm	**Nola Hancock** (Macquarie University, NSW) 'Climate-ready revegetation: A guide for natural resource managers'
4:45 – 5:00 pm	**Tricia Hogbin** (ANPC, NSW) 'Translocation of threatened flora – 20 years of guidance and networking by the Australian Network for Plant Conservation'

5:00 – 5:15pm	**Victorian Launch of the 'National Standards for the Practice of Ecological Restoration in Australia'** (Society for Ecological Restoration Australasia) @ Mueller Hall
5.15 – 6.30pm	**The *Senecio behrianus* POSTER SESSION @ Domain House** with casual drinks and canapes
Neeraj Sharma (University of Jammu, INDIA)	'Vegetation heterogeneity and impacts of changing climatic and land use patterns on the timberline ecotones of Upper Chenab catchment, Jammu and Kashmir,India'
Ben Zeeman (La Trobe University, VIC)*	'Invasive plants with persistence-related traits increase with urbanisation in an endangered grassland ecosystem'
Sutomo (Edith Cowan University, WA)*	'Effect of fire and digestion by herbivores on seeds of the exotic invasive species *Acacia nilotica* from Savanna at Baluran National Park Indonesia'
Catherine Dickson (Monash University, VIC)*	'Nowhere to hide? Conservation options for a endangered keystone species in the sub-Antarctic'
Mathew Dell (Ecology Australia Pty Ltd, VIC)	'Prioritising recipient sites for translocation of three threatened orchid species in NSW'
Simon Heyes (La Trobe University, VIC)*	'Recruitment bottlenecks in a keystone species: A demographic study of remnant *Banksia marginata* woodlands in Western Victoria'
Adrian Martins (North Central Catchment Management Authority, VIC)	'Rescuing Stiff Groundsell *(Senecio behrianus)* from extinction in Northern Victoria'
Rebecca Jordan (University of Melbourne VIC)*	'Conserving adaptive diversity: Genomics of climate adaptation in *Eucalyptus microcarpa* and implications for restoration'
Nick Schultz (Federation University Australia, VIC)	'Tree decline in the Coorong and Tatiara Districts, South Australia'

WEDNESDAY 16TH NOVEMBER 2016

8:30 – 9:00am	Registration @ Domain House
9:00 – 10:55am	Mueller Hall, National Herbarium of Victoria
9:00 – 9:40am	**PLENARY LECTURE 3: Dave Kendal** (University of Melbourne, VIC) 'How do people think about plants, and why is this important for plant conservation?' **Chair: Ben Zeeman** (La Trobe University)

The *Nematolepis wilsonii* session:	**CONSERVATION FOR PEOPLE AND NATURE: HOW DO WE MAXIMISE THE BENEFITS OF BOTH?** **Chair: Nick Schultz** (Federation University Australia)
9:40 – 9:55am	**Anne Cochrane** (Department of Parks & Wildlife, WA) 'Parks and people: Maximising the benefits of conservation'
9:55 – 10:10am	**Alison Farrar** (University of Melbourne, VIC)* 'Public evaluations of prescribed burning and removing or allowing woody vegetation to grow in Melbourne's critically endangered temperate grasslands'
10:10 – 10:25am	**Geoff Robertson** (Friends of Grasslands, ACT) 'Learning to conserve grassy ecosystems through advocacy, science and practise: experience of a community group'
10:25 – 10:40am	**Mel Hardie** (Department of Environment, Land, Water & Planning, VIC) 'New tools to help protect Victorian biodiversity'
10:40 – 10:55am	**Peter Stronach** (Landcare Tasmania, TAS) 'The devolved grant model: achieving lasting conservation outcomes in Tasmania'

10:55 – 11:25am	**MORNING TEA**
11:25 – 12:05pm	**PLENARY LECTURE 4: Leonie Monks** (Department of Parks & Wildlife, WA) 'Translocation principles and practice: Opportunities and challenges for threatened plant recovery' **Chair: David Coates** (Department of Parks & Wildlife, WA)

The *Pomaderris vacciniifolia* session:	**NEW CHALLENGES, EMERGING IDEAS** **Chair: Paul Gibson Roy** (Greening Australia)
12:05 – 12:20pm	**Sapphire McMullan-Fisher** (Fungimap, VIC) 'Community education helps threatened fungus: Tea Tree Fingers *(Hypocreopsis amplectens)* in Victoria, Australia'
12:20 – 12:35pm	**Tamara Taylor** (Griffith University, QLD)* 'The impact of Myrtle rust *(Puccinia psidii)* on the endangered *Gossia gonoclada* (Myrtaceae) in south east Queensland'
12:35 – 12:50pm	**Dianne Brown** (Office of Environment and Heritage, NSW) 'Fontainea dude thinks he's a lady - recovery of the Coastal Fontainea and investigation into temporal monoecy'

12.50 – 1.50pm	**LUNCH**

The *Commersonia prostrata* session:	**NEW CHALLENGES, EMERGING IDEAS (Continued)** **Chair: Susanna Venn** (La Trobe University)
1:50 – 2:05pm	**Nicholas Williams** (University of Melbourne, VIC) 'Green roofs as an opportunity for rare plant conservation and dispersal'
2:05 – 2:20pm	**Pamela Spencer** (University of Melbourne, VIC)* 'Direct seeding supports species rich, high cover novel green roof grassland'
2:20 – 2:35pm	**Megan Hirst** (Royal Botanic Gardens Victoria/The University of Melbourne, VIC)* 'Common gardens make common sense in novel times'
2:35 – 2:50pm	**Bob Makinson** (ANPC, NSW) 'Myrtle Rust: two species down, how many to go?'
2:50 – 3:05pm	**Karen Sommerville** (Royal Botanic Gardens & Domain Trust, NSW) 'Saving sensitive seeds'

3:05 – 3:20pm	**Amy Hahs** (ARCUE, RBGV VIC) 'Conserving resilient native plant communities in urban landscapes by supporting persistence, adaptation and transformation'

3.20 – 3.50pm	**AFTERNOON TEA**

The *Pterostylis basaltica* session:	**HOLISTIC CONSERVATION – THE ROLE OF MUTUALISMS IN ENSURING FUNCTIONAL ECOSYSTEM RECOVERY (POLLINATORS, SOILS)** **Chair: Trevor Edwards** (La Trobe University)
3:50 – 4:05pm	**Noushka Reiter** (Royal Botanic Gardens Victoria, VIC) 'Orchid re-introduction: from symbiotic propagation to pollinators'
4:05 – 4:20pm	**Eleonora Egidi** (La Trobe University, VIC) 'Metabarcoding as a promising tool for the *in situ* identification of mycorrhizal fungi associated with an endangered Victorian orchid: Results from a pilot study'
4:20 – 4:35pm	**Cathy Olive** (Euroa Arboretum, VIC) 'Direct seedling for revegetation in the Goulburn Brocken CMA: What are we achieving?'
4:35 – 4:50pm	**Kate Brown** (Department of Parks & Wildlife, WA) 'Return of the Australian Hollyhock *(Malva preissiana)* to Perth's offshore islands'
4:50 – 5:05pm	**Martin Breed** (University of Adelaide, SA) 'How can restoration avoid genetic ghettos, adapt to climate change, and effectively monitor success?'
5:05 – 5:30pm	The ***Sclerolaena napiformis* Student prizes** and conference close. **Prizes donated by Earth Welfare Foundation.**

7:00 – 10:10pm	**The *Westringia crassifolia* CONFERENCE DINNER** @ The Arbor at Village Melbourne, 557 St Kilda Rd Melbourne (cnr. Moubray St, opposite Wesley College), a few tram stops south from RBGV (Drinks not included).

THURSDAY 17TH NOVEMBER 2016

CONFERENCE FIELD TRIPS- all leaving from the RBGV, Melbourne at the Bus Parking Zone on Birdwood Avenue, between Observatory House and the Herbarium Building (Mueller Hall)

FIELD TRIP ONE	**FIELD TRIP TWO**	**FIELD TRIP THREE**
'Native Grass Seed Production and Large-scale Grassland Restoration'	'Grassy Woodland Restoration at Yanakie Isthmus, Wilsons Promontory National Park'	'The Role of Botanic Gardens in Applied Conservation'
9:00am – 4:00pm	8:30am – 5:00pm	9:00am – 4:00pm
Coordinators - **Simon Heyes** (La Trobe University), **Chris Findlay** (Flora Victoria) and **Paul Gibson-Roy** (Greening Australia)	Coordinator - **John Morgan** (La Trobe University)	Coordinator - **John Arnott** (RBGV)
In the morning, we will visit a native grass seed producer to learn about seed production at large scales at a commercial facility established near Melbourne. See how native grasses are farmed, harvested, sorted and stored. Then, we will visit Sydenham Park near Tullamarine Airport, a large-scale grassland restoration project that aims to re-establish dominant grassland species, as well as introducing grassland forbs into the matrix. This day will suit those interested in the practicalities of up-scaling seed production and grassland restoration, and provide insight into the pitfalls and solutions to such activities.	See how woodland restoration using an adaptive management framework is being implemented at Yanakie Isthmus to restore grassy woodlands overrun by fire-sensitive shrubs (e.g. *Leptospermum laevigatum*). By linking researchers, on-ground experimentation and land managers, and having a clear picture of how adaptive management works, you will see the outcomes of using controlled fire and herbivore control to recover the original ecosystem. Will suit those interested in grassy woodland ecology, ecosystem dynamics and landscape-scale management.	This field trip to the magnificent Royal Botanic Gardens Victoria, Cranbourne will focus on: 1) Threatened Orchid Conservation Research (including a tour of the Lab and nursery), 2) Climate Adaptation Research Plots, 3) managing of the remnant vegetation for conservation of ground fauna, and 4) viewing some of the Special Collections held at the Gardens. This field trip will suit those interested in propagation of threatened species, the role of Botanic Gardens in applied conservation, and remnant vegetation management.
Sponsored by **Flora Victoria** and **Brimbank City Council**	Sponsored by **Ecology Australia** and **Parks Victoria**	Sponsored by **Royal Botanic Gardens Victoria**

FRIDAY 18TH NOVEMBER 2016

CONFERENCE WORKSHOP

WORKSHOP - @ Mueller Hall, National Herbarium of Victoria.

'The Australian Native Seed Industry Review – The Purpose, The People, The Practice and The Proposals for Action.'

8:30am – 3:30pm

Coordinators - Martin Driver (ANPC) and **Paul Gibson-Roy** (Greening Australia)

This 'Call to Action' workshop will draw on both Dr Paul Gibson-Roy's plenary conference review of the American native seed industry and a pre-conference industry-wide on-line survey, along with workshop participation to identify what are the key issues, gaps and opportunities in the Australian native seed industry at this time.

The workshop and survey are targeting input and participation from the Australian Seed Bank Partnership, regional seedbanks, commercial seed collectors, seed companies, contractors/revegetators, restoration organisations, regional NRM bodies, State/Federal agencies, research institutions and casual collectors and enthusiasts.

The workshop will help identify what are some of the key issues and gaps in the Australian national and regional seed supply chains and how we fare against learnings from the American scene. This will help to identify and prioritise some critical elements that need to be addressed and identify opportunities, actions and key players to assist in creating a true native seed supply industry.

Sponsored by the **Rural Industries Research and Development Corporation (RIRDC)**

APCC11 Conference abstracts - 14 to 18 November 2016
Oral Presentations

KEYNOTE SPEAKER: Gregory Andrews (Threatened Species Commissioner)

The Australian Government's Threatened Species Strategy and the 30 plants we will save from extinction.

PLENARY LECTURE 1: Dr Jen Silcock (Threatened Species Recovery Hub, National Environmental Science Program (NESP), University of Queensland and Queensland Herbarium)

Lost in the desert or Red Hot? A botanical tour around Australia, beginning on the Paroo River.

My odyssey began on the Paroo floodplain near Hungerford in the spring of 2006, with the discovery of a small but distinctive burr *(Sclerolaena walkeri)* unseen for 50 years now flourishing in the land described by Henry Lawson as a 'blasted barren wilderness'. How could this plant, which I found in abundance across south-west Queensland's five major river systems, have gone undetected for decades and be considered Vulnerable to extinction? How many species in this vast, poorly-surveyed land had data on abundance, distribution and basic life history which could reliably inform their conservation status? What role did the archetypal boom and bust cycles of the arid-zone have on rarity and threat? My curiosity piqued, I began a journey by foot, car, pushbike, camel, kayak and helicopter that took me across 635 300 km2 of south-western Queensland over 10 years, collecting data to systematically re-asses the conservation status of the flora.

Through examination of Herbarium records and expert interviews, I identified 91 apparently rare and potentially threatened 'candidate species' from the 1800 vascular plant species occurring in the region. For each, I recorded my search effort (totalling over 3000 hours) and population data (at 2000 separate populations), which were used to assess species against IUCN criteria. With the exception of 12 artesian spring species, demonstrable threats and/or continuing declines were documented for just six species, while large (>1000 plants), healthy and regenerating populations of 64 of 91 species (70%) were found. The criterion that allows listing of species because of extreme fluctuations (in combination with restricted and fragmented populations) must be carefully interpreted in arid zones, where these fluctuations may be apparent rather than real, and can confer resilience to grazing. This systematic survey approach facilitates robust conservation assessments across vast and poorly known regions, distinguishing species that have merely been lost in space and time from those that are at risk of extinction.

Having spent a decade combing the not-so-dead heart for not-so-rare plants, I've now expanded my rare plant searching to cover the continent – although this time, sadly, it's mostly a desktop search, aimed at compiling a 'Red Hot' list of Australia's most imperilled flora as part of the NESP Threatened Species Recovery Hub. In stark contrast to the inland situation – where only a handful of species are genuinely threatened – many species are both rare and in serious trouble. Around 1100 plant species, about 5% of Australia's known total, are listed as Endangered or Critically Endangered (under state and/or federal legislation). A fifth of these survive only in a single population, while 60% are known from five or fewer populations. The Red Hot list will (1) identify species that are at most immediate risk of extinction using the best available expert knowledge; (2) identify and prioritise conservation management actions that can significantly reduce the likelihood of extinction for these species; (3) alert relevant stakeholders of this risk and recommended response. To be considered for inclusion, species must be both rare and declining, and have feasible recovery options. This narrowed field will then be assessed against fuzzier criteria such as flagship potential and phylogenetic uniqueness to arrive at the final Red Hot list. Some of the most threatened plants have been translocated, and my second NESP project will collate data about all translocations which have occurred in Australia and analyse their successes, shortcomings and lessons learnt.

It's been a long and winding trail in search of lost and threatened plants, and it is far from over. Each species holds its own secrets and stories, and provides a window on its habitat and insights into conservation for newcomers in an ancient land.

The Ballantinia antipoda session:
RESCUING SMALL POPULATIONS FROM EXTINCTION

Dr David Coates (Senior Principal Research Scientist, Department of Parks and Wildlife WA), Neil Gibson & Colin Yates (Department of Parks and Wildlife WA)

Extinction debt and the conservation of small isolated populations of rare and threatened plants in south west Western Australia

Extinction debt is the future extinction of species in an area due to past events and occurs because of delays between impacts on a species, such as habitat destruction and fragmentation. Extinction debt is most likely found in long-lived species, such as trees and woody shrubs, covering narrow geographic ranges. Limited reproduction and a lack of recruitment in small isolated populations will ultimately result in extinction despite the ability of individual plants to live for many years. This delayed extinction has important implications for conservation and management, as it implies that species may go extinct due to past actions such as habitat destruction, even if those actions have ceased. The south west flora of Western Australia has been subjected to major impacts since European settlement resulting in significant changes to the vegetation over large areas. These impacts are particularly evident in the heathlands and shrublands of the extensive agricultural region (Wheatbelt) where there has been broad scale land clearing and habitat degradation .Here we investigate extinction debt involving rare and threatened long lived woody shrubs in this region. Over 2,300 plant taxa are of conservation concern within the south west and some 70% of these are relatively long lived woody shrubs. Our initial assessment of rare and threatened species based on population size, area of extent and population isolation indicate that there is likely to be a significant extinction debt focused around those species with habitat destruction and associated habitat degradation, and introduced pathogens major contributing factors.

John Patykowski (PhD Candidate Deakin University)

Germination Ecology, Seed Dispersal, and Decline in a Critically Endangered Plant:
A Case Study of *Pomaderris vacciniifolia* (Round-Leaf Pomaderris)

Change in ecosystem disturbance regimes from human land-use poses a worldwide problem for management of rare species. Two important types of disturbance influencing the persistence of species in Australian ecosystems are habitat fragmentation and fire. We examined seed dispersal and the germination ecology of *Pomaderris vacciniifolia*—a critically endangered, rare endemic Australian shrub—to identify likely influences of fire and fragmentation on the decline of populations. The response of seed germination to simulated effects of wildfire and canopy openings was investigated, as was the unaided dispersal capability of seeds from parent plants. A significant increase in germination rate was observed following 100°C heat treatment to seeds while smoke and light exposure had little influence. Seed imbibition is strongly influenced by heat treatment. The findings indicate a positive post-fire germination response with implications for recruitment success determined by moisture availability following fire. Unaided seed dispersal is limited, which partly explains the apparent decline of populations. A global understanding of threatened species' disturbance requirements, and subsequent management of landscapes for disturbance, will aid conservation of rare species throughout the world.

Paul Foreman (Director and Senior Ecologist & Botanist, Blue Devil Consulting; PhD candidate La Trobe University) & Karly Learmonth (Department of Environment, Land, Water and Planning, VIC)

Ballantinia's road to recovery: Restoring the hydrology of a key population

Ballantinia antipoda (Southern Shepherd's Purse) is a tiny, nationally endangered, cool–season annual forb belonging to the Family Brassicaceae. Ballantinia is endemic to south–eastern Australia, but has disappeared from all known locations across its historic range with the exception of higher elevations on Mount Alexander, near Harcourt in central Victoria. Detailed censuses carried out in August 2011,13 &14 has given us a clearer understanding of Ballantinia's fine-scale distribution and habitat preference for mesic moss mats, as well as the key threats, including: changes in micro-hydrology; weed invasion; climate change; and human impacts near tracks and infrastructure. Current trends suggest Ballantina could be lost in the wild by mid-century without interventions like translocations and reducing local threats, as outlined in the National Recovery Plan. The key focus at Mount Alexander must be protecting and enhancing optimal habitat in sheltered aspects at high elevation. However, in 2014, when a large Ballantinia patch suddenly crashed five years after an escaped asset protection burn inadvertently impacted micro-hydrology, there was real alarm we might be witnessing the extinction of yet another important site. It is argued, weed invasion and an abandoned straw bale sediment barrier deprived downslope moss mats of moisture, eventually triggering a population crash with inevitable return of dry conditions. An urgent program of weed and litter removal, weed suppression and run-off enhancement was implemented in Autumn 2016 to restore micro-hydrology in a bid to either revive the population or to lay the groundwork for a subsequent reintroduction. While the works have proven hydrologically effective, the ultimate measure of success will be the return of a stable Ballantinia population at this site. In the context of a drying climate, this innovative strategy of fine-scale micro-hydrological repair and enhancement could prove useful at other vulnerable sites.

Geoff Carr (Ecology Australia Pty Ltd)

Undocumented diversity masks conservation status and threats in Correa (Rutaceae)

The genus Correa—comprising shrubs and small trees—is endemic in south-eastern and southern Australia (QLD–WA). Eleven species and 31 varieties are currently recognised in Correa. Taxonomically the genus is viewed as one with few species and often continuous or clinal morphological variation across wide geographical areas, as well as frequent hybridisation and population scale introgression; notably in *C. reflexa* and *C. lawrenceana*. Only a few taxa are regarded as threatened; *C. calycina var. calycina* (SA) and *C. lawrenceana* var. genoensis (VIC, NSW) are listed under the EPBC Act and several are listed under State legislation or policy.

Field, garden and herbarium morphological and ecological studies by the author indicate that there are numerous undescribed taxa (c.50% of the genus undescribed) and that the taxonomic rank of many should be re-evaluated and elevated. Reassessment of the taxonomy of Correa indicates that many populations or metapopulations are, in fact, seriously threatened and many are endangered or critically endangered. Threats include weed invasion, failure of recruitment, severe or lethal browsing by deer and wallabies, climate change, altered fire regimes, failure or reduction of pollination (by honeyeaters) and genetic pollution or hybridisation where cultivated Correa come into contact with natural in situ populations. The findings of these studies are discussed in relation to the conservation status, threats and management of Correa populations.

Brian Bainbridge (Ecological Restoration Planner, Merri Creek Management Committee) & Michael Longmore (Merri Creek Management Committee)

Genetic rescue of the Plains Yam Daisy (*Microseris scapigera*) on the Merri Creek.

A recently completed project (2010-2016) applied the ANPC guidelines for the translocation of threatened plant to Plains Yam Daisy, *Microseris scapigera* in the Merri Creek. Knowledge gaps on this species have been generated by taxonomic confusion, the plants rarity and inconspicuous appearance, and by marked influence of cultivation on the plants phenology and habit. Surveys of wild growing populations, phenology and habitat informed habitat management actions and a translocation trial using direct sowing into native grassland reserves. Translocations utilised seed orcharding, gap creation, soil disturbance and herbivore protection. Many of these activities were conducted with community volunteer input. Findings, results and directions for the future are reported. Challenges for on-ground practitioners working with this species are highlighted.

PLENARY LECTURE 2: Dr Paul Gibson-Roy (Lead Scientist Greening Australia)

An Australian's first hand observations of the US seed production and restoration sectors.

The feasibility of restoring or reinstating Australian temperate grasslands and grassy woodlands has been much debated over the past decade by our sector. Despite good evidence having emerged during that time that this is possible with good success, relatively little has been achieved at large scale. The reasons for this poor outcome are varied; but ongoing doubts concerning techniques, limitations on seed resources, ongoing debates about provenance ranges and a lack of market drivers to support large-scale or long term projects are among the most obvious explanations. At the same time there have been ongoing reports of much greater successes restoring native grassy communities in the United Sates (from both the literature and from first-hand observations). This disparity in experience led Paul to apply for a Winston Churchill Memorial Trust Fellowship. The generous support of the Churchill Trust enabled him to tour the United States and observe firsthand that sector, with a particular emphasis on the producers of native seed.

His presentation will detail that tour, shedding light on the scale and structure of native seed production enterprises across a wide swath of the US. He will describe the production systems used to procure, grow and process native prairie seed and give insights into the different restoration outcomes made possible through this seed supply chain. Finally, he will discuss the various market drivers, which together create the opportunity for a seed production and restoration sector that far exceeds anything that currently exists in Australia. Paul's Fellowship demonstrates what is possible when market drivers are in place to support large scale restoration and provides a powerful counter point to the current Australian situation. It is hoped that insights from his Fellowship may provide pathways for our sector to move in more positive and constructive directions.

Acacia enterocarpa session: RETHINKING LANDSCAPE RESTORATION: SEED PRODUCTION, PROVENANCE, CONSERVATION PLANNING

Dr Melissa Millar (Research Scientist, Department of Parks and Wildlife WA), David Coates (Department of Parks and Wildlife WA), Margaret Byrne (Department of Parks and Wildlife WA) & Dale Roberts (University of Western Australia)

An integrated approach to designing provenancing guidelines illustrated for landscape restoration in the Midwest of Western Australia.

Restoration ecology science has traditionally recognised the importance of compositional diversity in vegetation at the species and genetic level. More recently there has been increased acknowledgement of the need to match not only current but also potential future ecogeographic variables at seed source and restoration sites and of the role evolutionary processes such as gene flow play in maintaining the long term viability and persistence of restored populations and their functional integration into the greater landscape. This has led to descriptions of a plethora of provenancing approaches that expand upon the classical local provenancing paradigm. Despite this, there are few practical recommendations on how to utilise empirical knowledge to design effective seed sourcing regimes that achieve successful long term restoration. Here we describe an integrated method that considers the independent evolution and distribution of genetically divergent lineages, more contemporary patterns of genetic structure and gene flow, ecogeographic variables, and life history traits that affect population demographics and pollen and seed dispersal. The method utilises simulation modelling to indicate how various seed sourcing and establishment regimes, including the number of founding individuals, perform in the initial capture and maintenance of genetic diversity in restoration populations over future generations. We illustrate the method for provenancing of source material for restoration activities in the Midwest of Western Australia, an area where significant investment will be made in post-mining restoration over the coming decades.

Jim Begley (Landscape Restoration Officer, Goulburn Broken Catchment Management Authority

Seed Production Practice for a Changing Climate

Seed Production Area development of native flora species is a key future strategic solution to the survival of Australia's ecosystems. Native Plants are building blocks that provide a food source, shelter and oxygen for a diversity of life forms above and below the soil. The Biodiversity Strategy for the Goulburn Broken Catchment in Victoria has a target to increase the extent of native vegetation in fragmented landscapes by 70,000 hectares by 2030, and to improve the quality of existing native vegetation in this time. To achieve these targets, direct seeding became a greater focus for revegetation activities 15 years ago. In the Goulburn Broken Catchment a group of dedicated practitioners have been working together over many years to address the impacts of 200 years of clearing native plants from the Australian landscape. Seed production areas have been developed to address the seed shortage across the catchment - using guidelines established by FloraBank.

Fifteen years later, what have we learnt? In collaboration with CSIRO, we know genetics play an important role in the health of plant populations. Do plants collected from small wild populations persist? Do we skew the genetic representation in our seed production areas as plants senesce? How far and wide should we collect from? How do we track populations in seed production areas over time? We have many learnings to share from our experience and many new questions emerging, particularly around ecosystem adaptation and transformation as a result of climate change.

Dr Elisa Raulings (Business Unit Leader, Conservation Planning & Science, Greening Australia), Dr Kay Morris (the Arthur Rylah Institute) & Martin Potts (Greening Australia)

Planning the restoration of wetlands - where should we work?

Managers have historically managed wetlands at the site scale, but adequately protecting wetlands requires the protection or restoration of wetlands at the landscape scale. This can be done by determining the wetlands with which they are biologically linked and the pathways that facilitate movement of organisms between wetlands. Connectivity represents the ability of plants and animals to move among habitat patches in the landscape. Connectivity is an important consideration for managers because (a) it provides opportunities for native and introduced species to expand their range and migrate in response to local and regional changes in habitat conditions, (b) facilitates recolonisation following local extinction events and (c) increases genetic diversity by promoting gene flow among populations. Climate change will change the connectivity of the landscape by changing the habitat availability for aquatic organisms through flooding and drying, and changing habitat quality such as changes in salinity regimes. A transitioning environment requires careful stewardship to minimise biodiversity loss and to allow the area to adapt and evolve into resilient systems, especially under climate change. In this presentation we discuss how knowledge of habitat requirements, dispersal distances and landscape permeability can be combined with other spatial prioritisation tools for aquatic habitats to understand these connections and where we can be most effective in our on-ground actions. The utility of these maps in guiding spatial prioritisation of on-ground management activities will be discussed using the Gippsland Lakes wetlands as an example.

The Brachyscome walshii session: RETHINKING LANDSCAPE RESTORATION: SEED PRODUCTION, PROVENANCE, CONSERVATION PLANNING

Dr John Morgan (La Trobe University)

Targeting the timing of fire to restore ecosystem structure and function

Landscape ecology is the study of spatial patterns and processes and is used to enhance management of ecosystems at large spatial scales. Coastal grassy woodlands, comprising C4 grasses and trees such as Drooping She Oak, have declined dramatically in extent and condition in Victoria over the last five decades, with changes in land use and disturbance regime implicated in this decline. Typically, fire-sensitive shrubs (such as Coast Tea tree) have expanded into fire-resilient grassy ecosystems, turning them into dense, monospecific shrublands. The re-introduction of disturbance regimes, specifically fire, is one way to potentially restore the structure and function of the original ecosystem. We test the importance of timing of fire on structural recovery of coastal grassy woodlands at Yanakie Isthmus, Wilsons Promontory National Park. Late summer fires reinforce Coast Tea tree dominance at landscape-scales, by promoting 'wheat-field' regeneration derived from a canopy-stored seed bank. Early summer fire, by contrast, destabilizes the dominance of Coast Tea tree, occurring at a time when there is minimal seed load in the canopy from which to regenerate after fire. Hence, early summer fire allows low-statured 'grassy' ecosystems to recover with minimal Coast Tea tree, whereas late summer fire gives managers 'more of the same' shrubland. However, fire alone has not restored the structure or function of the grassy understorey. Post-fire herbivory (by native and exotic mammals) prevents full grassland recovery, presumably because of differences in palatability among species in the post-fire vegetation. Hence, the grassland canopy, and the fine fuels necessary to implement low intensity management fires and inhibit further establishment of Coast Tea tree, are unlikely to fully recover under current herbivore pressure.

Dr Maurizio Rossetto (Senior Principal Research Scientist. Royal Botanic Gardens & Domain Trust)

Restore & Renew: an innovative landscape-wide, multispecies project.

The flagship research project Restore & Renew, is a world-first initiative that will create a comprehensive and easy to use website readily accessible by the community and supporting effective and sustainable land restoration. Utilising novel whole-genome sequencing and environmental modelling techniques, we will uncover an unparalleled level of information to understand how genetic diversity is partitioned across the landscape, and if genetic provenances are associated with climatic and environmental variable. We will collect, analyse and share genetic, adaptive, environmental, and ecological data for over 200 plant species commonly used in restoration projects across Australia's Eastern seaboard and representing NSW's floristic diversity. No other project on this scale and scope exists worldwide and I will present the concept and preliminary outcomes of this large-scale study. Restore & Renew will deliver a readily accessible resource of comprehensive restoration and management guidelines on an unprecedented scale. This enduring community resource will improve the success and long-term viability of land restoration projects, as well as improve predictive capacity to respond to climate change. Beside supporting restoration practices, the project will also provide considerable amounts of information from species to landscape levels, discover regions of high genetic diversity, identify commonalities among taxonomic and functional groups that will improve our ability to generalise beyond the 200 species, and enable us to explore how species and assemblages are likely to respond through time. Understanding and predicting how plants will grow and interact in changing ecosystems is vital to conserving, or restoring, resilient natural habitats.

Nic McCaffrey (Senior Ecologist, WSP | Parsons Brinckerhoff; and associate at The University of Queensland), David Doley (The University of Queensland) & Peter Erskine (The University of Queensland).

Post-mined landscapes aren't the Garden of Eden: approaches for determining reference sites where ecosystem replacement is not the aim

Conventional and widespread approaches for restoration and rehabilitation of mine sites consist of restoring ecosystems back to a non-degraded version of the ecosystem prior to mining. Reference or analogue sites of the target ecosystem are often used as a model or benchmark for which the progress of restoration and rehabilitation is monitored against. This approach can be suitable for ecosystems and mine sites where there is a high likelihood of near-natural recovery. However, for many open cut mine sites and highly modified ecosystems, this kind of baseline has been likened to restoring the 'Garden of Eden': an unrealistic aspiration.

Mining often causes immense changes to the hydrology, topography and geology of an area. In addition, variability in topsoil handling, seeding operations, the level of early establishment management and other site conditions make it difficult to predict how rehabilitation will progress, particularly in the early years. Once the ecosystem successional trajectory is more predictable (demonstrated by a slowing of structural development trends, the stabilisation of species richness and progress towards the identified success criteria), it is appropriate to review or refine the reference targets.

In this presentation, we will explore how the process for determining mine completion criteria, target ecosystems for restoration and hence the type of reference communities requires rigour and justification to reflect the unique set of challenges described above. We also present a method for determining the type and location of reference sites using remotely sensed data and spatial datasets combined with site-specific conditions developed for four coal mine sites within Queensland's Bowen Basin.

Dr Nola Hancock (Associate Lecturer, Macquarie University), Rebecca Harris (Macquarie University), Linda Broadhurst (CSIRO) & Lesley Hughes (Macquarie University)

Climate-ready revegetation. A guide for natural resource managers

Rapid environmental change presents challenges and uncertainties for landscape managers. Many restoration and revegetation practitioners recognise that changes to current practices are needed, based on understanding habitat conditions expected in the future, rather than the historical baseline of the past. But how should natural landscapes be managed when the magnitude and direction of projected changes are uncertain and the conditions projected for local sites may not have been previously experienced?

A new publication, Climate-ready revegetation. A guide for natural resource managers, provides information on how to use on-line tools to gauge if existing vegetation (species and local populations) are likely to be suitable as the climate changes. To make these decisions, information on climate projections for the revegetation site, the climatic tolerance of the existing species (as indicated by the species' distribution), and the likelihood of survival of local populations are required. The Guide provides step-by-step instructions on how to (1) find and use on-line regional climate projections for a local site; (2) evaluate which plant species will be suitable at the site in the future; and (3) consider which strategy for selecting provenances will increase the likelihood of the local population surviving in the future? These steps are designed to acknowledge uncertainties about the nature and scale of physical change and to develop strategies that are as robust and climate-ready as possible, given our current knowledge base.

Dr Tricia Hogbin (Project Manager, Translocation, ANPC)

Translocation of threatened flora – 20 years of guidance and networking by the Australian Network for Plant Conservation.

Guidelines and information sharing have played a vital role in the development of translocation methods for threatened flora. The Australian Network for Plant Conservation (ANPC) released the first edition of 'Guidelines for the Translocation of Threatened Plants in Australia' 20 years ago. In subsequent years, the use of translocation increased, particularly as an ameliorative measure for development. A second edition was published in 2004, highlighting factors to consider when determining whether translocation is necessary and providing guidelines specific to ameliorative or compensatory translocations. The second edition was accompanied by the development of a one-day workshop on translocation which has since been run over a dozen times both nationally and internationally. These workshops were attended by almost 600 practitioners and decision makers and highlighted lessons learnt from dozens of translocation case studies. Relatively few translocation projects are documents in the scientific literature and these workshops provided a valuable opportunity for networking and information exchange that would otherwise be challenging. Since the 2004 edition, there has been noticeable positive progress in development of translocation methodologies and it has hence been decided that it is time for a third edition. This presentation will invite participation in development of the third edition and outline the update process.

PLENARY LECTURE 3: Dr David Kendal (School of Ecosystem and Forest Sciences, University of Melbourne)

How do people think about plants, and why is this important for plant conservation?

We are becoming increasingly interested in the social dimensions of conservation: what shapes the way people think about plants, and how does this thinking influence conservation outcomes? We (and others) have been exploring people's values, beliefs and attitudes to nature, and their response to the management of vegetation. This work shows that society's values have changed over the last 50 years – we have shifted from a utilitarian to a mutualistic relationship with nature, and people have strong values for nature, both inside and outside cities. At the same time, the community is diverse and different people have diverse opinions. Geography is not a very good predictor of the way people think – but their interests are. This means that the general public often thinks differently than special interest groups, or experts. The good news is that people are often more supportive of conservation than we assume.

The Nematolepis wilsonii session: CONSERVATION FOR PEOPLE AND NATURE: HOW DO WE MAXIMISE THE BENEFITS OF BOTH?

Dr Anne Cochrane (Senior Research Scientist, Department of Parks & Wildlife WA)

Parks and people: Maximising the benefits of conservation

Plant translocations are a conservation tool that aim to reinstate or augment declining or lost resources and they should be used to help inspire a public sense of optimism in the face of biodiversity loss. However, plant conservation activities in Western Australia often suffer from a low public profile and a lack of media attention. Yet, since 1998 more than 60 threatened species have been translocated to new locations in the wild in this State, including existing and new sites or those where the species are now locally extinct. Only one of these projects has deliberately focussed effort on interpreting the conservation activity for the public. Here, I will present a case study of interpretation provided for a translocation project for the critically endangered *Acacia awestoniana* from the species-rich Stirling Range National Park in Western Australia's South West. Safe public access, a viewing area and interpretative signage were provided for the new translocation site in a bid to reduce the potential for trampling, introduction of disease and taking of material for private or commercial purposes. The escalation in numbers of threatened plant species in Western Australia requiring translocation as a conservation measure predicates the potential for further such interpretive efforts. Improving public understanding of conservation issues and government responses, including research actions that aim to assist wild plant conservation, ought to enhance people's awareness and appreciation of Western Australia's natural heritage and the sometimes seemingly insurmountable issues involved in its conservation.

Alison Farrar (Student, University of Melbourne), Dave Kendal (University of Melbourne) & Kath Williams (University of Melbourne)

Public evaluations of prescribed burning and removing or allowing woody vegetation to grow in Melbourne's critically endangered temperate grasslands

The Victorian Volcanic Plain Grasslands is among Australia's most endangered ecosystems. Important remnants are being surrounded by rapidly expanding human settlements, yet little is known about public perceptions of this ecosystem. We assume that the degradation of Melbourne's grassland estate is, in part, a result of low levels of community appreciation for treeless ecosystems, and public concerns over fire as a management tool. To test this, we examined the values, beliefs and attitudes of nearby residents for grasslands and their management (removing woody vegetation, allowing woody vegetation to grow and prescribed burning). A psychometric questionnaire was posted to households within 100 meters of 38 grassland reserves in Melbourne. A factor analysis (n=477) was used to identify concepts underling people's values and beliefs. Six dimensions of values for nature in cities were identified (culture and heritage, commercial, natural, social, recreational setting, experiential), and four dimensions of beliefs of the consequences of prescribed burning and allowing woody vegetation to grow (positive social benefits, negative consequences for people, positive benefits for grasslands, nice environment for people). Attitudes to grasslands and prescribed burning were generally positive, although there was a segment of the community with strongly negative views. There were relationships between people's beliefs about positive benefits for grasslands and acceptance of prescribed burning, and strong relationships between values for nature, beliefs about positive social benefits and acceptance of allowing woody vegetation to grow.
This information will enable grassland managers to understand public perceptions of management, thus improving communication avenues between managers and residents.

Geoff Robertson (Friends of Grasslands, ACT)

Learning to conserve grassy ecosystems through advocacy, science and practice: experience of a community group.

Friends of Grasslands (FOG) was established in 1994 with the aim of supporting grassy ecosystems in south east Australia. Through time it has developed a mix of advocacy, education, field trips, communications, on-ground projects, citizen science and monitoring strategies to identify, protect, manage and restore grassy ecosystem sites, especially natural temperate grasslands and grassy woodland. It has brought together government, researchers, land owners and managers, traditional Aboriginal owners, and volunteers with an interest in natural landscapes, vegetation, and indigenous species, especially those associated with grassy ecosystems. FOG has aimed to influence government legislation and policy, rural and urban development, research, and land management that impacts on biodiversity and threatened species. It has a strong emphasis on on-ground outcomes, community education, and increasing knowledge and management skills.

FOG has learnt many lessons and, using these lessons, is focusing on future directions. Broadly these lessons include: identifying key conservation issues and gaining support for them, influencing government decision making and resourcing, bringing stakeholders together, building up networks, carrying out restoration projects, developing good governance, imparting skills and fund raising. FOG projects have included: establishing the grassland conservation and restoration agenda in the Canberra region, achieving good on-ground outcomes at many sites, influencing ACT offset policy, conducing major flora and fauna surveys, publications, and promoting traditional Aboriginal land management techniques. All this work is based on volunteer effort. The presentation will give some examples of these lessons and projects that conference participants may find useful.

Mel Hardie (Senior Biodiversity Curator, Department of Environment, Land, Water & Planning)

New tools to help protect Victorian biodiversity

Victoria has a diverse and unique array of species and ecosystems that we value and need to protect for future generations. We need a revolution in our thinking about how to best conserve nature and give species the best opportunity to adapt. Whilst we collate and manage a large state wide dataset, the Victorian Biodiversity Atlas, there are substantial gaps, both temporal and spatial, which makes it difficult to make informed decisions on land management and investment.

In order to help decision makers in the community, government or agencies make the best informed decisions, the Department of Land Water and Planning (DELWP) have developed a process to generate Habitat Distribution Models of threatened species. These decision-support tools use a range of spatial and aspatial information as well as verified species observation data to generate modelled distributions of where species are likely to occur. These can be further refined to inform, at a landscape scale, priorities areas for conservation or regulatory controls as well as areas of uncertainty where we need further survey effort.

Peter Stronach (Membership Officer, Landcare Tasmania)

The devolved grant model: achieving lasting conservation outcomes in Tasmania

Landcare Tasmania is an experienced facilitator of on-ground restoration and protective activities of high conservation areas. This paper provides details of the grant process that delivered funding to landholders managing high conservation areas across Tasmania. Landcare Tasmania secured funding from the Australian Government's Clean Energy Futures Biodiversity Fund. The three and a half year project allowed for a more longer-term and larger –scale strategic approach than most other grant schemes. Outcomes from 89 sites included the long-term management of weeds across 4,100 hectares, protecting 1,700 hectares and the active restoration and regeneration of 340 hectares around and within high conservation vegetation.

A staged funding process enabled conservation planning and delivery to include both primary and seasonal follow-up weed control, best practice protection measures and planned restoration activities. The project maximised participation leading to greater involvement and ownership from the land managers. The devolved grant structure adopted and refined by Landcare Tasmania resulted in a cost effective delivery of enduring landscape-scale conservation management actions. Using a staged approach, the process was open to innovation and complementary methods, limiting risk and maintaining rigour and technical integrity. This framework used a proven, strategic and regional approach that achieved measurable improvements to biodiversity values. The paper highlights five key aspects of the devolved grant model: program development; application process; assessment criteria; project tracking; and extension support. The paper discusses how these have contributed to more effective targeting, monitoring, and evaluation of funding activities.

PLENARY LECTURE 4: Leonie Monks (Department of Parks and Wildlife, Science and Conservation Division, WA)

'Translocation principles and practice: opportunities and challenges for threatened plant recovery'.

Translocations aim to prevent species extinction by creating or maintaining viable populations and are increasingly being undertaken world-wide in an attempt to stem the tide of biodiversity loss. For a translocation to be effective in helping conserve a population or species, it must be able to successfully establish in the short term and become self-sustaining in the long-term. Challenges for conservation practitioners can include difficulties with propagation, effectively characterising translocations sites to ensure the optimal sites are chosen, improving translocation methodologies to maximise translocation survival and adequately defining and assessing success so it is understood when success is achieved and when resources can be reallocated to other species in need. However, despite the challenges, there are also many opportunities. Where an experimental framework is used we can expand our knowledge on species ecology and conservation, and use this knowledge to continually improve our translocation techniques and increase our chances of success. We can also scale up the knowledge learnt from one or more species to more broad-scale restoration activities. But ultimately the greatest opportunity for conservation practitioners is to significantly reduce the risk of a species going extinct.

The Pomaderris vacciniifolia session: NEW CHALLENGES, EMERGING IDEAS

Dr Sapphire McMullan-Fisher (Fungimap) & Tom May (Royal Botanic Gardens Victoria)

Community education helps threatened fungus: Tea Tree Fingers (*Hypocreopsis amplectens*) in Victoria, Australia

Tea Tree Fingers (*Hypocreopsis amplectens*) is the only macrofungus FFG listed in Victoria and has rarely been recorded in the last decade. As well as being rarely recorded very little is known about this species or its habitat requirements. To increase awareness about this species and find out about likely conservation requirements surveys and educational materials were developed and used to inform the local community. The educational materials were designed to help people recognise Tea Tree Fingers and associated fungi, as Hypocreopsis are fungicolous (live on fungi). Surveys were designed to increase the population, substrate and habitat condition, so called "data rich" surveys to be used if this species was observed at the sites during monitoring or opportunistically if noticed at other times. Hopefully this data will help the management of these sites for multiple biodiversity and community values.

These materials and surveys were then used hold workshops to train the public how to carry out data rich surveys for substrates and habitat condition when they come across this fungus. These workshops were aimed at local naturalist and environmental groups, as these groups are often the main on ground conservation activities including biodiversity monitoring. By increasing public awareness of the Tea Tree Fingers and its conservation needs Fungimap hopes to stimulate ongoing conservation actions to protect this threatened fungus and the habitat and species on which it depends.

Tamara Taylor (PhD Candidate, Griffith University)

The impact of myrtle rust (*Puccinia psidii*) on the endangered *Gossia gonoclada* (Myrtaceae) in south east Queensland

Myrtle rust (*Puccinia psidii*) is an invasive fungal pathogen that quickly spread throughout vulnerable Australian ecosystems after accidental introduction in 2010. The disease is particularly prevalent in Queensland where environmental conditions are ideal for the disease year- round. To date, little quantitative research has been conducted on the impact of myrtle rust on some of Australia's most endangered species. This research is the result of three years observation of the in-situ impact of myrtle rust on the endangered *Gossia gonoclada* (Myrtaceae) - a riparian rainforest endemic of south east Queensland. Over three years, a categorical scoring method was used to quantify myrtle rust severity on 87 trees within five separate populations in Logan City. These trees were previously propagated from 17 of the original 73 parent trees discovered in the 1980's, and planted in mixed assemblages in new locations as part of the National recovery plan for the species. Disease incidence and severity varied among the trees within all populations. A genetic study is currently underway to determine if there is a relationship between plants with similar disease severity that can be matched to parent trees. This information could be used to identify potential trees as sources of material for future propagation programs. As there has been significant tree mortality and an impact on reproductive capacity in *Gossia gonoclada* since the introduction of myrtle rust, the conservation of genetic material has become a priority so that diversity can be preserved under conditions that protect them from the disease.

Dianne Brown (Senior Threatened Species Officer, Office of Environment and Heritage), Rhonda James (Bushland Restoration Services) & Annette McKinley (Landmark Ecological Services)

Fontainea dude thinks he's a lady - recovery of the Coastal Fontainea and investigation into temporal monoecy.

The Coastal Fontainea is likely to be the rarest rainforest tree in NSW, with only ten genetically distinct adult wild plants known. The conservation of the species is even more precarious as plants are either male or female (dioecious), and was originally thought to consist of only one female plant. A conservation translocation program has increased the number of plants in nearby habitat to over 220, with each site planting consisting of representative individuals of every adult plant. This clumped planting design aims to maximise cross-pollination opportunities of each individual to reduce the risk of inbreeding.

Ecological monitoring of Fontainea has had some surprising discoveries. A couple of years into the project, one of the plants previously determined to be a male produced fruit. Since then, we have discovered that, not only is there more than one female plant, it appears that some plants can alternatively produce either male or female flowers. This may be a form of "temporal monoecy" and continues to be investigated by the project team. The translocation program has involved a wide range of community engagement activities involving a range of local groups, individuals and schools. An "Adopt-a-Fontainea" program has resulted in three private landholders, a landcare group and a local high school hosting and monitoring sets of plants. This monitoring will incorporate measuring growth rates and health as well as identifying the sex of each plant when they flower. Habitat restoration in the very restricted Littoral Rainforest community continues to protect the wild plants and encourage natural regeneration. The translocation program is now in its seventh year and planted specimens are up to 4m tall and are producing fruit and seeds. Some of these seeds have been provided to the Australian Plantbank for viability testing and storage.

Associate Professor Nicholas Williams (University of Melbourne), Claire Farrell (University of Melbourne), Jeremy Lundholm (St Mary's University, Canada) & John Delpratt (University of Melbourne)

Green roofs as an opportunity for rare plant conservation and dispersal

Green, or vegetated, roofs are novel ecosystems that are becoming increasingly common, particularly in the world's cities. Many native species, including Microtis and Prasyophyllum orchids in Melbourne, have been found to spontaneously colonise green roofs and they can also be planted with rare species or communities. Green roofs therefore offer a new opportunity for plant conservation. This presentation explores this potential, suggesting the characteristics of species that may be benefit from conservation on green roofs and reports on trials to establish native grassland community on four 18 m2 green roof beds on the Pixel Building. These were planted with 29 species from the critically endangered Victorian volcanic plain in July 2010 and their survival and recruitment monitored over three years.

Green roof substrates are typically made from relatively light-weight, porous, low nutrient materials such as scoria, crushed brick, pumice or heat expanded clay that we have found to be very suitable for seed germination. As such, above ground plant competition on green roofs is typically low which may enable persistence of rare species threatened by nutrient enrichment. Australian candidates include rare "weedy natives" such as *Barbarea australis, Lepidium hyssopifolium* and *Senecio macrocarpus*. Because these species are prolific producers of easily germinated seed, populations could persist on green roofs. The height of green roofs could also be used to disperse the species into the surrounding landscape, which in urban areas could include areas of suitable habitat such as disturbed ground and vacant lots.

The results demonstrate the species- and population-specific nature of plant responses to gradients of environmental change. Some common responses occurred across experiments: well-established cross-species patterns generally upheld along the gradient, but decoupling of patterns occurred at the local level. Against expectations, population variation was not reliably associated with geographical location on the rainfall gradient, suggesting that selection for local adaptation in response to water availability or other climate factors has been minimal. Despite this outcome, species expressing phenotypic variation along environmental gradients may have greater capacity to respond to global change. We discuss the value of *ex situ* conservation of populations across a species geographic range and caution the use of mean species values when modelling the impact of a changing climate on species persistence.

Pamela J. Spencer (Masters Student, School of Forest and Ecosystem Science, University of Melbourne), John Delpratt (University of Melbourne), Stephen J. Livesley (University of Melbourne), & Nicholas S. G. Williams (University of Melbourne)

Direct seeding supports species rich high cover novel green roof grassland.

Green roof vegetation has demonstrated value as a biodiversity provider. With vegetation selected at habitat level, green roofs have potential as a conservation tool. Abiotic boundaries on green roofs although similar to a few on ground habitats, are not exactly replicated, and novel communities only may be created. Manipulation of these novel green roof communities, may contribute to conservation as; a pollinator refuge, foraging site and corridor; a seed harvest source, a seed rain contributor to on ground biodiversity and in the conservation of rare species taxa. This research engaged grassland restoration direct seeding knowledge, as an ecological approach towards supporting early grassland community assemblage on green roofs. The investigation focused on evaluating a number of sowing techniques onto green roof substrate, and the species abundance, richness and cover responses of a diverse mix of grassland forb species. Key findings include that green roof substrate is an effective germination media and provides a safe site for seedling establishment; and that on ground restoration sowing rates are more than adequate in achieving abundant species rich high cover. However, in contrast to on ground direct seeding at surface method, sowing at depth under variable outside conditions onto green roof substrate, produced greater or equivalent abundance for many species. Additionally abundance rather than species richness was indicated as a key driver of early cover development, but not as seedlings matured. These findings inform early novel grassland forb community assemblage, and have practical application in community design and establishment as a conservation tool in a city landscape.

Megan J Hirst (Seedbank Officer/PhD Candidate Royal Botanic Gardens Victoria; University of Melbourne), Jason P Sexton (University of California) & Dr Ary A Hoffmann (University of Melbourne)

Common Gardens Make Common Sense in Novel Times

Transplants and controlled common garden experiments have classically been used to test for genetic differentiation and local adaptation in plant populations and are powerful tools to test performance across habitat types, both within and beyond present range limits. Here we tested fitness and survival of a set of alpine daisy species, some restricted to specialized habitats within the alpine zone, and some with a broader geographic niche. Using field-based (Bogong High Plains, Victoria) reciprocal transplant experiments accompanied by common garden experiments (Royal Botanic Gardens Victoria, Cranbourne site), we tested whether widespread species would outperform their restricted relatives in a broad range of environments.

We found restricted species performed best in specialized environments whereas widespread species outperformed them in novel ones. However, some alpine species grew well beyond their current range, and there was limited evidence for local adaptation. These results suggest that loss of habitat where restricted endemic species occur would affect their long-term persistence under environmental change. Nevertheless, in the common garden outside of their geographic range, restricted species were able to tolerate novel conditions, suggesting the potential for these species to persist in managed refugia. Common garden experiments are a useful method to test and evaluate fitness of species from different environments across a range of natural and novel habitats, and may help in developing conservation strategies that rely on active management.

Bob Makinson (Vice-president, ANPC)

Myrtle Rust: two species down, how many to go?

Since 2010, the fungal pathogen *Puccinia psidii* has naturalised along Australia's east coast and marginally in Victoria, Tasmania and the Northern Territory. 376 host species have been recorded in Australia so far, most of them native, and about 50 have been rated as highly or extremely susceptible. These numbers will rise. Impact data has only slowly emerged, as fewer than a dozen species are under systematic observation. Two common species of no previous conservation concern are now crashing catastrophically, and will be effectively extinct in the wild very soon. Up to another 40 or 50 highly susceptible species occur entirely within the east Australian Myrtle Rust 'zone', most of them mesic forest taxa. This pathogen, and perhaps others to come, pose a new set of challenges for conservation strategy and investment. For the species most severely at risk and with no apparent resistance, no safe refugia are available within the natural bioclimatic envelope. In the absence of any likely form of biocontrol of the pathogen, the only possible recovery strategies for the most highly threatened species involve concepts and methods that are new to Australia (for plants), and there are few overseas models available. The scientific, social and resource challenge is to undertake extended ex situ breeding for resistance and re-wilding of resistant genotypes without bottlenecking the natural genetic diversity of the species involved. This paper is a situation report, a brief look at the conservation responses to date (including ANPC's work), the options available, and the lessons for environmental biosecurity.

Dr Karen Sommerville (Scientific Officer Royal Botanic Gardens & Domain Trust), Graeme Errington, Z-J Newby & Cathy Offord (Royal Botanic Gardens & Domain Trust)

Saving sensitive seeds

Seedbanking is invaluable in providing insurance against extinction for individual species and a store of material that can be used in restoration. Many plants from rainforest habitats, however, are expected to have seeds that aren't suitable for standard seedbanking – either because the seeds are sensitive to drying or because they are sensitive to freezing. Over the past 3 years, we have tested this assumption for > 350 Australian rainforest species by comparing the germination of fresh seeds to that of seeds dried at 15% relative humidity and seeds stored at -20ºC after drying. We have also tested the comparative longevity of species that retain high viability following freezing using a rapid aging experiment. A third of species tested to date have been orthodox - tolerant of both drying and freezing - and so are suitable for standard seedbanking. The remaining species have been sensitive to drying to some degree or sensitive to freezing. Eight of ten orthodox species tested to date have also proven to be comparatively short-lived under artificial aging conditions. While some rainforest species can be stored using standard seedbanking protocols, the high proportion of species that have so far been found to be desiccation sensitive, freezing sensitive or short-lived in storage indicates that alternative protocols will be required for many rainforest plants. Methods currently being trialled at the Australian PlantBank include slow growth tissue culture, cryopreservation of apical buds and cryopreservation of excised embryos.

Dr Amy Hahs (Ecologist, ARCUE, Royal Botanic Gardens Victoria)

Conserving resilient native plant communities in urban landscapes by supporting persistence, adaptation and transformation

Urban areas in Australia are home to over 30% of our threatened plant and animal species. In some cases, it is precisely these plant and animal species that make our cities unique in the world. With Australia's highly urbanised population expected to double over the remainder of the 21st century, there is an urgent need to find opportunities to maintain and conserve the diversity between and within native plant communities in our urban landscapes. To support the conservation of native plant communities, we need to ensure they are able to persist, adapt, and even potentially transform in response to changing environmental conditions. This presentation examines how we can begin to explicitly incorporate actions that support persistence, adaptation and transformation in the planning and management of urban plant communities. These actions will improve our ability to deliver effective conservation outcomes for plant communities now and into the future.

The Pterostylis basaltica session: HOLISTIC CONSERVATION – THE ROLE OF MUTUALISMS IN ENSURING FUNCTIONAL ECOSYSTEM RECOVERY (POLLINATORS, SOILS)

Dr Noushka Reiter (Botanist, Royal Botanic Gardens Victoria), Julie Whitfield (Amaryllis Environmental), Gail Pollard and Mary Argall (ANPC), & Raymond L. Tremblay (University of Puerto Rico, Centre for Applied Tropical Ecology and Conservation, San Juan, Puerto Rico, USA.)

Orchid re-introductions: from symbiotic propagation to pollinators

It is expected that re-introductions will be a major strategy globally for in-situ orchid conservation into the future. Australia has more than 1700 species of orchid, three-quarters of these are terrestrial and represent 197 (16%) of all federally listed species, more than any other plant family. The Royal Botanic Gardens Victoria is leading an innovative conservation partnership to collect, store, propagate and re-introduce threatened terrestrial orchids into their native habitat. The program has propagated over 30 nationally threatened species and together with partner organisations has completed over 40 re-introductions. Partners currently include land management agencies, state government agencies and private industries. Community groups are critical to the project, providing expertise and resources to compliment the support from government and the scientific community. The Australasian Native Orchid Society, in particular, has assisted with most re-introductions to date.

Each orchid species has a complex relationship with the environment, including requirements for mycorrhizal fungi, pollinators and microhabitat. To restore populations under threat, a thorough understanding of a plant's ecology and biology are required, as well as the support of relevant land managers and community groups. We present a framework for orchid re-introductions and recommend a thorough study of mycorrhizal associations and, for specialised pollination syndromes, pollinator interactions, prior to site selection and the re-introduction of plants. Moreover, it is imperative that we understand not only the biotic interactions of the life history dynamics of these species but also abiotic interactions in natural populations to evaluating if re-introductions are effective.

Dr Eleonora Egidi (Postdoctoral Researcher, La Trobe University)

Metabarcoding as a promising tool for the in situ identification of mycorrhizal fungi associated with an endangered Victorian orchid: results from a pilot study.

Mycorrhizal fungal communities in terrestrial ecosystems play a crucial role in regulating nutrient cycles, and maintaining ecosystem structure and function. Their occurrence and abundance can also be critical in determining the distribution of orchids with specific mycorrhizal requirements. Therefore, being able to monitor the presence of mycorrhizal fungi "hot spots" in situ is important to assess suitable areas for rare orchids reintroduction. Metabarcoding, a novel cost-effective method of surveying organisms based on the identification of genetic material directly from environmental samples, is potentially a more consistent method to determine the occurrence of mycorrhizal fungi in soil compared to traditional techniques. In the contest of assessing a strategy to support the in situ survival of the nationally endangered Victorian orchid *Diuris fragrantissima*, we conducted a pilot study to evaluate the implementation of a metabarcoding approach (ITS1 fungal region) to map the distribution of its mycorrhizal fungus *Tulasnella calospora* in the orchid's native site. Operational Taxonomic Units (OTUs) identified as *T. calospora* have been retrieved from three soil samples, supporting the potential for a successful use of this approach to identify and target microsites containing mycorrhizal fungal communities for recruitment and/or reintroduction of endangered orchids.

Cathy Olive (Project Manager, Euroa Arboretum), Janet Hagen & Dr Jenny Wilson (Euroa Arboretum)

Direct seeding for revegetation in the Goulburn Broken CMA: what are we achieving?

The Goulburn Broken CMA direct seeding is a method of revegetation that is used widely because it is relatively inexpensive and can be carried out over large scales. The aim of this study was to evaluate direct seeding revegetation undertaken between 1999–2009 in the Goulburn Broken catchment to identify factors that influence success of conservation outcomes among sites. We designed a monitoring protocol (pointing method) that targeted attributes able to indicate a site's relative trajectory along the restoration path and its capacity to be self-regenerating. We used an information theoretic modelling approach to test hypotheses about the influence of environmental, ecological and management factors on our 'success' indicators (stem density and species survival in furrows, natural regeneration outside furrows, and abundance of weeds).

Weed cover was high at most direct-seeded sites, due to the legacy of fertiliser use, but crash grazing supressed weed abundance. Plant density was too high, and species diversity was reduced from original seed mixes. There was little regeneration from direct seeding, and at 6–15 years old, sites are not capable of being self-sustaining. Direct seeding practices will be changed, including pre-works site management, seed mixes, distribution of seed during direct seeding, and ongoing site management. Further research will use the same method to experiment with management actions at sites (eg burning, scalping) with an aim of increasing regeneration from direct seeded plants.

Kate Brown (Ecologist, Bushland Restoration, Department of Parks and Wildlife, WA), Aurelie Labbe (Murdoch University), Grazyna Paczkowska & Leonie Monks (Department of Parks and Wildlife, WA)

Return of the Australian Hollyhock (*Malva preissiana*) to Perth's off shore islands.

Malva preissiana or Australian Hollyhock is restricted to offshore islands around the western and southern coasts of Australia. With a life cycle linked to that of nesting seabirds it grows specifically in their guano deposits. The habitat is nutrient rich, continually disturbed by seabird trampling and highly susceptible to weed invasion. The species is considered vulnerable in Victoria and competition from weeds has had a major impact on populations on Islands off the coast of Perth. In recent decades *M. preissiana* has gone extinct from Rottnest, Green, Bird, Seal, and Penguin Islands. Carnac Island and Shag Islands now support the only populations of *M. preissiana* in the region. Over the last five years seed has been collected from the Carnac Island population and stored at the Department of Parks and Wildlife Threatened Flora Seed Centre.

The type collection for *M. preissiana* was from Penguin Island in 1839 but unfortunately the species disappeared from there sometime in the 1970s. In 2014 a series of trials were initiated on Penguin Island investigating effective establishment techniques for the reintroduction of *M. preissiana*. The results indicate direct seeding into the guano deposits of recently vacated Pelican roosts can result in establishment of adult plants as long as weeds are managed in the early stages of establishment. Plants flowered and set prolific amounts of seed in the second year of the trials. The study provided a management framework for the reintroduction of *M. preissiana* to Perth's offshore Islands and is part of a larger restoration plan for Penguin Island. The next phase of the project will involve acquiring resources to scale up the trials and through an adaptive management process, work towards re-establishing self-sustaining populations on Penguin Island.

Dr Martin Breed (DECRA Fellow, University of Adelaide), Nick Gellie, Jacob Mills & Andrew Lowe (University of Adelaide)

How can restoration avoid genetic ghettos, adapt to climate change, and effectively monitor success?

The world has vast areas of degraded land and is experiencing severe declines in valuable ecosystem services. In response, ambitious targets have been set to restore these degraded landscapes. However, several issues remain problematic with current-day restoration activities. How do we avoid establishing restoration plantings that are genetic ghettos? How do we establish habitat that is going to be resilient to future climate change? And how can we effectively monitor restoration success and the functional return of ecosystems? In this talk, I will address and present some options for each of these issues.

The *Senecio behrianus* POSTERS

Dr Neeraj Sharma (Assistant Professor, Institute of Mountain Environment, University of Jammu, India) & Dinesh Singh (University of Jammu)

Vegetational heterogeneity and impacts of changing climatic and land use patterns on the timberline ecotones of Upper Chenab catchment, Jammu and Kashmir, India

The alpine landscapes in the Himalayas are the result of climate evolution and century spanning interactions between humans and the fragile natural environment through co-existence regimes. The timberline ecotones of upper Chenab catchment rich in terms of community heterogeneity are exposed to several degrees of threats, mostly anthropogenic (habitat loss and fragmentation, Invasive species, species exploitation, environmental contamination, etc). Migratory pastrolism, pilgrimage and TMAP extraction, etc. exhibit large scale human-ecosystem interactions along these sensitive interfaces thus altering the timberline significantly on spatial and temporal scales. The study area forms the south-western part of Chenab catchment namely Kailash Kund circuit between Chattergala and Kailash ridge with an altitudinal range of 2700 to 3800 m asl. We have studied the complex dynamics of timberline ecotones in context with vegetation composition, phonological responses to microclimatic changes and allied environmental variables, biomass and productivity, carrying capacity and livelihood dependency of marginal communities on these ecosystems.

Ben Zeeman (PhD Student La Trobe University)

Invasive plants with persistence-related traits increase with urbanisation in an endangered grassland ecosystem.

Globally, natural grasslands are becoming increasingly surrounded by urbanised landscapes, with exotic plants invading as local and egional environmental attributes are altered. We examined the composition of exotic plant functional traits in the endangered grasslands of Melbourne, against the spatial attributes of remnant patches and the surrounding road network at multiple scales. We predicted that (1) intense landscape modification favours an exotic flora invested in resource acquisition and urban tolerance, (2) high road density in the immediate vicinity of remnants drives high propagule pressure, resulting in high exotic functional diversity, and (3) exotic species that spread and become abundant do so through an investment in competitive traits.

Exotic species contributed to 31% of total cover in Melbourne's native grasslands, with regionally widespread species dominant within sites. Life-form was the single trait associated with dominance, with exotic grasses achieving high cover over forbs and shrubs. Road density across the urban landscape was positively associated with exotic perennial grass cover, and negatively associated with community-weighted SLA. At local scales, road density in the immediate vicinity of grasslands was positively associated with exotic plant functional diversity.

Urbanisation favoured invaders invested in persistence over resource acquisition, potentially in response to the urban climate and declines in fire frequency. Re-introducing historic fire regimes has the potential to reduce competition between invaders and the native flora. High exotic functional diversity in areas of high local road density was the expected response to propagule pressure. Urban planning that protects grasslands from road encroachment may therefore reduce invasion.

Sutomo (PhD candidate, Edith Cowan University WA)

Effect of fire and digestion by herbivores on seeds of the exotic invasive species *Acacia nilotica* from Savanna at Baluran National Park Indonesia

Savanna in Baluran National Park East Java Indonesia has been invaded by the woody plant *Acacia nilotica* since the late 1960s, where its original purpose was to create fire breaks and prevent fire spreading from the Baluran Savanna to adjacent teak forests. However since then *A. nilotica* has spread rapidly and is threatening the existence of Baluran savanna as it has been observed to cause changes in ecosystem from open savanna to a closed canopy of *A. nilotica* in some areas. We hypothesized that fire and herbivore grazing/digestion plays an important role in establishment of *A. nilotica* seeds and ultimately expansion of *A. nilotica* stands in the Baluran savanna. In order to test this hypothesis, we conducted field observation of herbivores stools and conducted an *A. nilotica* seed germination experiment. Our results show that: (1) fire and grazing are important factors in terms of determining the retreat or advancing of *A. nilotica* stand towards savanna; and (2) although fire has a detrimental effect on *Acacia nilotica* seed, however grazing by buffalo appears to benefits *A. nilotica*. These results further confirmed the important of understanding the seed biology and other characteristics of invasive alien species (IAS) in native ecosystems and also confirmed the important roles of seed dispersal through animal digestive systems.

Catherine Dickson (PhD Candidate Monash University)

Nowhere to hide? Conservation options for an endangered keystone species in the sub-Antarctic.

The endemic keystone species *Azorella macquariensis* (Macquarie cushions) has undergone a rapid widespread decline across Macquarie Island, resulting in its listing as critically endangered in 2010. The species is a major component of the Island's fellfield ecosystem and is considered a landscape engineer, concentrating resources across the plateau. The change in climate on the island has resulted in local drying and reduced available water during the active summer growth period of *A. macquariensis*, which is thought to be driving the decline of the species and increasing its susceptibility to pathogens. The current extent and progression of dieback in this keystone species could indicate the beginning of a catastrophic regime shift on Macquarie Island. However, the dieback is patchily distributed suggesting that refuges exist. Over the next three years this project will work to identify plant and ecosystem traits that are responsive to climate variables and assign baseline parameter values, determined by the literature and collective knowledge of the multi-institutional project team. The resultant information will be used to identify climate change refugia across Macquarie Island for *A. macquariensis* and to predict both the species and associated fellfield ecosystem's response under a number of future climate change scenarios. The resultant knowledge will enable the development of an evidence-based monitoring system, advancing our knowledge about *A. macquariensis* and the associated fellfield ecosystem, and enabling the appropriate management of the species and development of a predictive conservation framework for fellfield ecosystems more widely.

Dr Matt Dell (Principal Botanist, Ecology Australia Pty Ltd), Geoff Carr (Ecology Australia Pty Ltd), Dr Helen Waudby (NSW Office of Environment and Heritage) & Geoff Robertson (NSW Office of Environment and Heritage)

Prioritising recipient sites for translocation of three threatened orchid species in NSW

Caladenia concolor Fitzg., *Caladenia arenaria* Fitzg. and *Diuris callitrophila* D.L.Jones are terrestrial orchid species which are threatened with extinction. The distribution of *C. concolor* includes southern NSW and northeast to central VIC while *C. arenaria* and *D. callitrophila* are confined to southern NSW. A collaborative program has been developed between government and non-government organisations to increase populations of these species in the wild. The program focuses on the ex situ propagation and introduction of these plants into sites of suitable habitat, while the current objective is to provide decision support for recipient site selection and prioritisation. A literature review, ecological assessment of extant populations and stakeholder consultation were undertaken to enable the development of spatial datasets used in Multi-Criteria Analysis (MCAS-S). Results provide a spatial representation of risk to translocation success and consider both site values and perceived threats to the persistence of translocated plants.

Simon Heyes (La Trobe University), Dr John Morgan (La Trobe University), Steve Sinclair (Department of Environment, Land, Water and Planning VIC) & Dr Susan Hoebee (La Trobe University)

Recruitment bottlenecks in a keystone species: a demographic study of remnant *Banksia marginata* woodlands in Western Victoria.

Recruitment limitation of tree species has become a global problem for woodlands and savannahs across the globe. These systems have experienced shifts in disturbance regimes, unmanaged herbivores, or the loss of important plant-animal mutualisms. On the Victorian Volcanic Plains (VVP), B*anksia marginata* suffered rapid decline soon after European settlement and populations are now restricted to small, isolated roadside remnants. Anecdotally, NRM agencies and land managers have observed further decline, with reports of widespread recruitment failure or the absence of seed production over multiple years. Unfortunately, there have been few studies focussing on these forgotten woodlands of the VVP. With growing impetus to restore *B. marginata* woodlands by NRM agencies, there is a need to answer key questions about the demography and recruitment processes to ensure the success of future management and restoration. Without this, future conservation and restoration efforts are likely to suffer similar problems. In this study, we undertook a size-class analysis across remnants on the Victorian Volcanic Plains to identify if populations were experiencing widespread recruitment bottlenecks. We found that recruitment bottlenecks were not widespread, with some populations recruiting well, while others are not. Untangling the drivers of observed recruitment variation is now necessary to separate out abiotic, biotic and genetic influences.

Adrian Martins (Project Manager, North Central Catchment Management Authority)

Rescuing Stiff Groundsell (*Senecio behrianus*) from extinction in Northern Victoria

Stiff Groundsel (*Senecio behrianus*) is a small shrub that is endemic to south-eastern Australia, where collections of it were made in scattered locations in South Australia, New South Wales and Victoria in the 1800s. The species suffered widespread decline in distribution and abundance and it was presumed extinct until rediscovered at Corop in northern Victoria in 1991. Since this re-discovery another 5 wild populations have been found and it has been re-introduced to 3 sites. All populations are <0.25 hectares in extent and most occur in areas where land management may conflict with the species survival (road reserves and freehold land).

The NCCMA, funded through the Australian Government's National Landcare Programme (NLP), is delivering a project to re-introduce this species into areas of suitable habitat in areas managed primarily for nature conservation. Seed and cuttings have been collected from all known populations and plants have been propagated at a specialist indigenous nursery. Some wild populations of Stiff Groundsel probably only consist of a few genetic individuals and, as the species in self-incompatible, do not produce viable seed. Plants from all populations have been grown together in the nursery where they can cross-pollinate, and viable seed was collected and sown this year from these nursery-cultured plants. A study has been conducted to identify the key habitat characteristics of the sites where wild populations occur and data from this study has been used to identify suitable sites for re-introduction. Over the past 2 years 100 plants have planted out at these sites.

Rebecca Jordan (PhD Candidate, University of Melbourne), Prof. Ary Hoffmann (University of Melbourne), Dr Suzanne Prober (CSIRO) & Dr Shannon Dillon (ANU, Canberra)

Conserving adaptive diversity: Genomics of climate adaptation in *Eucalyptus microcarpa* and implications for restoration

The mere presence of plant species in a landscape affected by environmental change does not necessarily ensure long-term persistence of plant populations. This is especially true in highly fragmented landscapes such as the wheat-sheep belt of south-eastern Australia, where reductions in population size and connectivity may decrease the potential of populations to adapt to future climate. This has led to new guidelines for restoration and seed sourcing that do not solely focus on local material but include material from other regions with the aim of maintaining genetic diversity and adaptive potential. However, understanding the extent to which species are adapted to different climates is critical for identifying appropriate non-local seed sources**.**

Utilising the power of genomics, we employ DArTseq, a reduced-representation genomics approach, to investigate genomic diversity and adaptation in *Eucalyptus microcarpa*, an important revegetation species used extensively across agricultural south-eastern Australia. This work aims to investigate adaptation at the genomic-level as well as identify environmental factors potentially influencing adaptive diversity in this species. Genomic outliers tests identified over 151 genetic regions that appear to be under selection. Of these, 123 were associated with climatic variables relating to temperature, precipitation and aridity. We then characterized the physical distribution of these sites across the genomes as well as associated genes and pathways. Together these results suggest there is evidence of climate adaptation in *E. microcarpa*. Building on recent suggestions for alternative seed sourcing strategies, we use these results to suggest approaches to seed sourcing in *E. microcarpa* under climate change.

Dr Nick Schultz (Research Fellow, Federation University Australia) & Dr Megan Good (Federation University Australia).

Tree decline in the Coorong and Tatiara Districts, South Australia

Tree decline is happening in most agricultural regions of Australia, yet the causes vary significantly between regions. As such, despite the ubiquitous nature of tree decline, each region faces a unique combination of issues, and requires a bespoke set of management options. Our study region – the Coorong and Tatiara districts of southeast South Australia – exhibits many causes of tree decline. We reviewed the current knowledge of tree decline causes in the region that were identified in the literature, or by discussions we held with land managers and stakeholders. Some of the causes of tree decline are well understood – e.g. dryland salinity and phytophthora root rot. However, we require a better understanding of (1) the complex and interactive effects of some causes of tree decline, and (2) the extent and severity of each issue across the region. This inhibits the development of suitable management options. To address these challenges, we are developing a citizen science project to allow land managers and stakeholders to contribute data on instances of tree decline. This data will be interrogated in conjunction with available GIS data (e.g. soils, topography and climatic data) to gain a better understanding of the extent, severity, and spatial distribution of the suite of tree decline causes, and the environmental parameters associated with each cause. This will allow a more strategic development of management options. We present our review as a case study for regions that need to address tree decline in agricultural landscapes.

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