‘Biodiversity Across the Borders’ Conference

Theme: “**ENHANCING ECOSYSTEM MANAGEMENT AND RESTORATION”**

ABSTRACTS

University of Ballarat
Mt Helen, Ballarat
Victoria

Edited by: S. K. Florentine & G. J. Ambrose

7th June 2013

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Program

8:00	**Registration** **VENUE**: **1870 Founders Hall Theatre**, Mt. Helen campus, University of Ballarat	
8:40	**Introduction and Welcome** **PROFESSOR JOHN YEARWOOD** – Dean, School of Science, Information Technology and Engineering, University of Ballarat	
8:45	**Welcome** **PROFESSOR DAVID BATTERSBY** – Vice Chancellor, University of Ballarat	
8:50	**Opening of '*Biodiversity across the Borders*' conference** **PROFESSOR KATE AUTY** – Commissioner for Environmental Sustainability, Victoria	
9:00	**Introduced by: Professor Frank Stagnitti** - DVCR, University of Ballarat **Keynote Address:** **PROFESSOR DAVID LINDENMAYER**, The Fenner School of Environment & Society, ANU Effective Ecosystem Restoration and Management.	
	VENUE: Caro Main Hall Theatre CHAIR: PROFESSOR PETER GELL	
	PLENARY SESSION 1	
9:35	**PROF. MIKE CLARKE** (LA TROBE UNIVERSITY) **& PROF. ANDREW BENNETT** (DEAKIN UNIVERSITY) Mallee fire and fauna: insights from a large-scale study.	
9:55	**ASSOCIATE PROFESOR IAN LUNT** (CHARLES STURT UNIVERSITY) Connecting landscapes across Victoria: we've achieved much more than we think.	
10:20	**EMERITUS PROFESSOR MARTIN WESTBROOKE** (UNIVERSITY OF BALLARAT) The role of private reserves within the national reserve system.	
	Morning tea 10:40 – 11:15 **POSTER SESSION** **Venue: TBA**	
	SESSION 2	
	Corridors to networks to continental conservation **VENUE: Caro Main Hall Theatre** **CHAIR: DR. PETER SPOONER**	**New insights in fire ecology** **VENUE: Studio** Theatre **CHAIR: DR. GRANT PALMER**
11:20	**PROFESSOR ANDREW BENNETT** Large-scale connectivity and the conservation of biodiversity: an introduction.	**ASSOCIATE PROFESSOR ALAN YORK** Fire, landscape pattern and biodiversity.
11:35	**DR. ROD VAN DER REE** Connectivity for Squirrel Gliders: across farm paddocks, roads and the east coast of Australia.	**MATT SWAN** The influence of fire-mediated environmental heterogeneity on ground-dwelling mammal diversity.

11:50	**ASSOCIATE PROFESSOR PAUL SUNNUCKS** Genetic connectivity is a key element of connected landscapes: worry A LOT more about having too little than too much!	**HOLLY SITTERS** Contrasting responses of understory birds to planned fire in south-east Australia.
12:05	**DR. JOHN KOEHN** Fish movements and stream connectivity.	**SARAH KELLY** Planned spring burning in Box-Ironbark forest: investigating the impacts on breeding Scarlet Robins.
12:20	**ANNA LISTER** Gene flow and connectivity in a widespread butterfly species.	**BEN ZEEMAN** Re-introducing fire into a long-unburnt coastal woodland: changes in stand structure and composition.
	LUNCH BREAK 12:35 – 1:30, Albert Coates Complex	
	SESSION 3	
	Corridors to networks to continental conservation **VENUE: Caro Main Hall Theatre** **CHAIR: PROFESSOR ANDREW BENNETT**	**Restoration & Connectivity** **VENUE: Studio Theatre** **CHAIR: ASSOCIATE PROFESSOR IAN LUNT**
1:45	**DR. JAMES FITZSIMONS** Linking Australia's Landscapes: lessons and opportunities from large-scale conservation networks.	**ASSOCIATE PROFESSOR DAVID WATSON** Of mistletoe and mechanisms: a resource-based approach to identify drivers of woodland biodiversity.
2:00	**DR. PETER SPOONER** Slopes to Summit (S2S); using a local landscape approach to achieve large-scale connectivity outcomes.	**DR. TRICIA WEVILL** An audit of riparian restoration: following a restoration trajectory or meandering through a changed landscape?
2:15	**DR. PIA LENTINI** Managing and planning for conservation of the NSW stock route network.	**NICOLE COGGAN** Restoration of ecosystem engineers affects habitat use by a key detritivore.
2:30	**DR. SOPHIE BICKFORD** The Central Victorian Biolink initiative: harnessing and empowering the Landcare and conservation management network community to achieve whole-of-landscape conservation.	**DR. BIRGITA HANSEN** Riparian zone widths, restoration objectives and catchment land use: management guidelines.
2:45	**DR. GRAEME NEWELL** An approach for identifying habitat connectivity at regional scales.	**DR. DAVE KENDAL** Community values for publicly managed natural land in Victoria.
	Afternoon tea 3:00 – 3:30 **POSTER SESSION**	
	Session 4	
3:35	Panel Discussion: **Ecosystem management, connectivity and biodiversity conservation** **VENUE: Caro Main Hall Theatre CHAIR: Professor KATE AUTY** Panel Members: Professor Mike Clarke, Emeritus Professor Martin Westbrooke, Dr. Pia Lentini, Dr. Ian Walker and Dr. James Fitzsimons	
4:50	**Closing Address**: **ASSOCIATE PROFESSOR IAN LUNT**	

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KEYNOTE ADDRESS:

Effective Ecosystem Restoration and Management

DAVID LINDENMAYER [1, 2, 3]

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Abstract

Increasing human population size, increasing resource demands, and increasing environmental impacts from resource extraction, coupled with other factors (not the least of which is a rapidly changing climate) mean that humanity is facing its largest ever challenges. One such challenge is to produce more food without compromising the environmental integrity of agricultural landscapes. Yet, approaches like land-use intensification may well do just that and lead to "bio-perverse" outcomes. What then can be done to achieve ecological sustainability of farming enterprises? A critical part of the solution will be good science that yields evidence of effective ecosystem management, including effective restoration efforts. To date, such science and associated scientific evidence has been sadly lacking in the vast majority of major environmental funding programs in agricultural landscapes, spanning NHT through to the current Biodiversity Fund. However, evidence gathered through research by an increasing number of workers in the temperate woodlands of NSW is beginning to highlight the effectiveness of management interventions that enhance the condition of existing patches of remnant native vegetation and the effectiveness of replanting as for some elements of the biota. This talk highlights how the amount of vegetation cover in the South-west Slopes region of NSW has increased significantly over the past decade with concurrent (and statistically linked) increases in detections of many species of birds. It is suggested that it is critical to build a greater body of credible science about which management interventions are successful and which ones are not. This is essential to more strongly foster a culture of true evidence-based policy and true evidence-based management as part of efforts to transition to ecologically sustainable farming enterprises in which food production is appropriately integrated with the maintenance (and/or significant improvement) of other values like the conservation of biodiversity.

The Mallee fire and fauna- insights from a large-scale study

MICHAEL CLARKE[1†,] AND ANDREW BENNETT[2]

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Abstract

Ecological fire management in Australia is often built on a basic assumption that if one aims for a mosaic of different vegetation types and seral stages in a landscape the needs of animals will be met. However, this assumption has rarely been tested and there is little evidence to define the characteristics of desirable or undesirable mosaics. We undertook a multidisciplinary study of the responses of a range of taxa (birds, mammals, reptiles, plants and key invertebrates) to fire in the Murray Mallee region of SA, NSW and Victoria. We compared the animal diversity of 28 landscapes (each 12.6 km^2 in area) exhibiting differing levels of pyrodiversity at a range of spatial scales. This required sampling fauna, flora, habitat characteristics and fire history at both the landscape and the site level (n = 280 pitfall lines, 560 bird survey points) over a period of two years. Our large scale space-for-time substitution approach enabled us to identify and compare the habitat characteristics and fauna at sites spanning a century-long post-fire time-frame. We found no evidence of increased faunal diversity being associated with an increased diversity of fire age classes at the scale of our landscapes, although heterogeneity of fire ages at a regional or landscape management unit scale may be important. We did find that several taxonomic groups exhibited increased diversity as the proportion of the landscape that had not been burnt for at least 35 years increased. Our study has generated region-wide vegetation and fire history mapping, a new method for aging mallee and predictions regarding the likely consequences of increased fire frequency for fauna and key habitat features (e.g. hollow-bearing trees). Such insights will inform the management of mallee ecosystems in southern Australia for the future.

Connecting landscapes across Victoria: we've achieved much more than we think

IAN LUNT[†], LISA SMALLBONE AND ALISON MATTHEWS

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Abstract

Connectivity planning has received lots of attention in recent years, with major projects (such as Habitat 141 and the Great Eastern Ranges Initiative) designed to increase habitat linkages between remnants and regions. Through improved connectivity we hope to increase the opportunity for species to migrate and survive as climate and land-use change intensifies. While many activities have resulted in fantastic outcomes, the scale of works undertaken is far smaller than the scale of planned and desired outcomes. Superficially this mismatch may promote a feeling of despair, yet we have achieved far more revegetation than we think in recent decades. Unassisted, 'passive' regeneration is widespread in many areas, but is largely overlooked and grossly under-valued. By focusing on intentional plantings we ignore the larger areas that have regenerated without human assistance. We argue that, to maximise outcomes with minimal resources, we need to expand our focus from intentional revegetation exercises, and ask, 'how can we best integrate revegetation activities with past, present and likely future outcomes from passive revegetation?' We will provide an overview of passive regeneration in Victoria, highlighting where it is occurring, why it occurs and what it can deliver for biodiversity conservation. In many cases, passive regeneration is unlikely to ever resemble the original ecosystem. Instead, passive revegetation can increase the diversity of vegetation structures and promote high regional diversity of some organisms (especially birds) by creating *different* habitats, not more of the same. If we refine our aims, expectations and practices, and integrate passive regeneration with intentional replanting exercises, we can efficiently expand habitat and landscape connectivity, and receive the best 'bang for our buck' as we do so.

The role of private nature reserves in connectivity

MARTIN WESTBROOKE

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Abstract

A key element of connectivity of natural landscapes is the National Reserve System (NRS), which is based on the concept of a 'comprehensive, adequate and representative reserve (CAR) system'. Whilst much of the NRS is made up of Commonwealth, state and territory reserves, private reserves are increasingly complementing this system. Whilst it is recognised that they have a major role to play there are complex legal, economic and institutional issues that need to be addressed. In this paper the guidelines for the NRS are reviewed, including management categories, representativeness and determining adequacy. Issues relating to private nature reserves, along with benefits and limitations, are discussed in relation to examples involving non-government organisations and private landowners. These include the Australian Wildlife Conservancy, Trust for Nature, Birds Australia, University of Ballarat, and the South West Mallee and West 2000 schemes.

Large-scale connectivity and the conservation of biodiversity

ANDREW BENNETT

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Abstract

Connectivity has been a prominent and sometimes controversial theme in conservation biology over the last 25 years. In recent years, increasing attention has been given to the potential benefits to nature conservation of maintaining and enhancing connectivity at large spatial scales – ranging from landscapes and regions to entire continents. At least three approaches to large-scale connectivity projects can be recognised. First, there are projects where the stimulus or rationale is based on the conservation requirements (and potential movement paths) of wide-ranging species, such as large predators and migratory species. Second, there is a suite of projects where the goal is to preserve or re-establish continuity of natural environments between two or more established conservation reserves. A third approach involves designating a broad zone or swathe of land in which the goal is to develop connected systems of habitat, typically comprising different land tenures. This latter approach is typified by the concept of 'biolink zones' proposed in Victoria, national 'wildlife corridors' recently outlined by the Commonwealth Government and a number of grass-roots connectivity projects underway around Australia. However, many questions and uncertainties surround the objectives, design, management and evaluation of such connectivity zones. This series of presentations at the 'Biodiversity across Borders' conference is intended as a forum for sharing knowledge and experience about large-scale connectivity in SE Australia. Our goal is that different perspectives relating to biological aspects of connectivity, the planning and management of existing and developing networks, community involvement and design approaches will stimulate further discussion on this significant issue for biodiversity conservation in Australia.

Connectivity for Squirrel Gliders: across farm paddocks, roads and the east coast of Australia

RODNEY VAN DER REE

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Abstract

The Squirrel Glider is a small-medium-sized arboreal marsupial that occupies woodland and open forest from the base of central Cape York, down the east coast of Australia into western Victoria and just over the border into South Australia. Its preferred habitat coincides with high quality soils suited for agriculture, and the loss and fragmentation of habitat for farming and, more recently, urban development are key threatening processes. Squirrel Gliders like to glide and, when clearings exceed their glide length, they are forced low to the ground where they risk entanglement with barbed wire fencing or collision with vehicles. While they can move across the ground when forced to, they are clumsy and prone to predation. In this presentation I will discuss what connectivity means for Squirrel Gliders across a range of spatial scales. At the paddock scale, gliders have a maximum threshold of ~70m, beyond which paddock trees are "out of reach". Narrow single-carriageway roads are readily traversed, but major dual-carriageway highways that lack trees in the median are an almost complete barrier to movement. These movements are best restored by retaining tall trees in the centre median or by installing canopy rope bridges or artificial glider poles. Strips of woodland along roadsides and waterways are effective corridors for gliders, facilitating long-distance movements. At the continental scale, populations of gliders in the northern part of their range are genetically distinct from those in the south, suggesting a reduction in connectivity over time. The patterns in genetic differentiation suggest prioritising the maintenance of existing connectivity in the north and restoration of connectivity in the south. Our extensive research on the Squirrel Glider demonstrates the importance of understanding the local and landscape-scale patterns in connectivity to achieve the conservation of this species.

Genetic connectivity is a key element of connected landscapes: worry A LOT more about having too little than too much!

PAUL SUNNUCKS

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Abstract

Wildlife management interventions have often been inhibited by concerns that too much gene flow between different populations or stocks will cause outbreeding depression (loss of fitness through combining lineages that are differently adapted or otherwise incompatible) and may lead to loss of local adaptation. While these can sometimes be valid concerns, they generally pale into insignificance compared to the much more pervasive, powerfully negative effects of inbreeding depression, caused by too little gene flow (too much isolation and small genetically effective population sizes). Situations likely to cause outbreeding depression are often quite obvious in advance, and a risk-analysis approach can be taken, with adaptive management as necessary. Local adaptation may indeed sometimes be lost by too much gene flow, but this may be a price that has to be paid for species or populations to persist in any form. In any case, there are no guarantees that currently locally adapted forms will remain locally adapted under human-induced environmental change. Natural selection is the most powerful defence species have against changing environments, so high connectivity leading to high effective population sizes and strong adaptive potential will often be something profound we can offer to wildlife. But gene flow is not a panacea: viable populations require demographic as well as genetic connectivity. We may be able to enhance both of these kinds of connectivity in natural populations by increasing habitat extent, connectedness and increasing its quality. However, the characteristics of a functionally (as opposed to just physically) connected landscape will differ for different species, and requirements in the landscape for genetic and demographic connectedness may differ. Optimizing landscape reconstruction requires understanding these issues. I illustrate this by reference to collaborative research on woodland birds through much of the Box-Ironbark country of northern Victoria.

Fish movements and stream connectivity

JOHN KOEHN

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Abstract

I suspect that most people attending this conference will work in terrestrial research or management. Indeed as terrestrial beings we have more affinity with terrestrial processes- such as movements. The movements of fish are usually much more restricted than for many other animals, generally linked to the linear nature of stream networks, and often onto floodplains, if and when they are available. Indeed, river systems are great corridor networks. This paper aims to provide some concepts of fish movements and stream connectivity; highlighting the differences to terrestrial animals. The linear nature of movements restricts transfers between catchments and the many in-stream barriers (up to 10 000 in the Murray-Darling Basin) fragment fish populations and can prevent major movements altogether. Fish have to actively swim; often against a stream current (energy expensive); but they can also disperse through the lazy downstream options of passive swimming or drifting (especially for eggs and larvae). If you drift down, however, how do you get back up over a weir or through a road crossing? Fish move both upstream and down, often for spawning but, like other animals, for foraging, finding habitats, general recolonisations or to avoid predators or poor conditions. They undertake local movements, with many species exhibiting limited home ranges, high site fidelity and homing (Trout Cod, Freshwater Blackfish). Large-scale movements have been recorded for many species: Golden Perch > 2000 km; Murray Cod 120 km; Carp – many hundreds of kilometres; Short-finned Eels – 5000 km to the Coral Sea. Providing fish passage (fish ladders and fish lifts) around barriers is an important management option for rehabilitating fragmented fish populations. The 'Sea to Lake Hume' project has included building ten new fishways that open up over 2300 km of the Murray River to fish movements.

Gene flow and connectivity in a widespread butterfly species

ANNA LISTER[1†], PAUL SUNNUCKS[2], MELANIE NORGATE[3] AND NEIL MURRAY[1]

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Abstract

Managers often use studies of the genetic structure of species to guide management decisions in fisheries and conservation biology. Estimates of gene flow and genetic differentiation between populations can, however, vary according to the genetic marker used, leading to different interpretations of population connectivity. Here we present an example in a widespread butterfly species (Common Brown butterfly, *H. m. merope*), using two sets of genetic markers to assess population structure. One marker set (allozyme) appears to be under selection, and gene flow estimates vary according to what type of selection affects them. The other marker set (neutral DNA markers) provides lower estimates. It is important to consider the characteristics of genetic markers when evaluating the connectedness of populations for conservation and management purposes.

Fire, landscape pattern and biodiversity

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Abstract

Following the release of 'Living With Fire - Victoria's Bushfire Strategy' in 2008, DEPI (then DSE) introduced a landscape-scale mosaic burning program to create spatially heterogeneous environments, which theory suggests should have a positive impact on biodiversity. By providing a mix of fire to create a more extensive range vegetation age-classes (i.e. increased landscape patchiness), mosaic burning aims to break up large homogeneous landscapes. It is assumed that mosaic burning will also help reduce the size, severity and impact of large-scale fire events, and maintain healthy and resilient ecosystems. Since 2009, supported by funding from DEPI and Parks Victoria, our research group has been exploring the relationships between disturbance, habitat heterogeneity and biodiversity at a variety of spatial scales. Based in the Great Otway National Park and Otway Forest Park in southern Victoria, our researchers are investigating whether patterns of fire in space and time influence the availability of resources for fauna. Is there a positive relationship between environmental heterogeneity and species diversity, and if so, at what spatial scales? How do animals respond to fire and what can managers learn from this? In the first phase of our research, thirty-six 100 ha. 'land mosaics' (each consisting of 5 sites) were established; sampling combinations of vegetation types and their post-fire growth stages. Biodiversity data were collected through systematic survey at 182 sites to enable quantification of relationships between landscape pattern and species diversity, abundance, behaviour and related processes. These data provide correlative tests of the environmental heterogeneity hypothesis at spatial scales relevant to land management. In the second phase, a smaller-scale manipulative experiment was established, using planned fire to enable causal links between fire, diversity and associated processes to be quantified. Using a before-after-control-impact (BACI) design, with paired catchments, the project investigated the short-term impact of planned burning on landscape heterogeneity and associated biodiversity at the scale of a single burn block. Using some examples from the project, this talk explores how future fire management in the Otways might best address biodiversity conservation issues in the face of higher planned burn targets.

The influence of fire-mediated environmental heterogeneity on ground-dwelling mammal diversity

MATT SWAN[†], JULIAN DI STEFANO, FIONA CHRISTIE, HOLLY SITTERS, ERINE STEEL AND ALAN YORK.

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Abstract

There is a widely held assumption in fire management that maximizing the diversity of growth stages across a landscape will benefit biodiversity. This is supported by studies on a range of taxonomic groups that have shown that different species peak in abundance at different stages of post-fire vegetation development, and ecological theory that suggests environmental heterogeneity is important for the maintenance of biodiversity. There are, however, few explicit tests of this hypothesis, particularly at landscape scales. We conducted a quasi-experimental study to investigate the influence of fire-mediated environmental heterogeneity on the species richness and beta diversity (species turnover) of ground-dwelling mammals. We conducted Elliott trapping and camera trapping surveys over two years across a 59000 ha section of the Otway Ranges in south-western Victoria, a highly diverse landscape, with respect to time since last fire and vegetation type. We quantified heterogeneity in two ways: 1. using map-based spatial pattern metrics derived from Ecological Vegetation Divisions (EVDs) and growth stages and 2. using indices derived from site-based structural and floristic characteristics. We found that, contrary to predictions, heterogeneity defined by growth stages and EVDs was not influential in driving species richness or turnover. However, heterogeneity defined by habitat structure was influential in predicting species turnover and the strength of this relationship varied along a rainfall gradient. These results suggest that in this landscape there is a complicated relationship between fire, habitat structure and productivity and maximising diversity of growth stages is unlikely to show tangible benefits to overall mammal diversity.

Contrasting responses of understory birds to planned fire in south-east Australia

HOLLY SITTERS[1†], FIONA CHRISTIE[1], JULIAN DI STEFANO[1], PAUL SUNNUCKS[2] AND ALAN YORK[1]

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Abstract

Planned fire is used extensively in south-east Australia to mitigate wildfire risk. Recently it has also been applied to achieve ecological outcomes, and it is widely agreed that patchy fires of low severity are conducive to biodiversity conservation. Low severity fire is associated with the presence of faunal refugia, the spatial arrangement of which is often a function of topographic complexity. For example, wet gullies are less likely to be affected by low severity fire, and it is plausible that they provide refugia for birds. We tested this prediction using a before-after control-impact experiment in a topographically variable area. Generalized linear mixed models were used to examine the influences of fire and topography on two understory insectivorous birds, Superb Fairy-wren (*Malurus cyaneus*) and White-browed Scrubwren (*Sericornis frontalis*). Both species were present in gullies at the impact area after fire. White-browed Scrubwrens avoided burnt ridges and became largely confined to gully refugia, reflecting its preference for dense habitat. In contrast, the Superb Fairy-wren remained on ridges and expanded its distribution to gullies. Our data suggest that spatial variation in fire severity associated with topographic complexity enabled both species to persist after planned fire, and demonstrate contrasting responses to disturbance by understory insectivorous birds. Strategic use of topographic features in planned burning operations might help to facilitate ecologically sensitive fire management.

Planned spring burning in Box-Ironbark forest: investigating the impacts on breeding Scarlet Robins

SARAH KELLY[1†], MICHAEL CLARKE[1] AND ANDREW BENNETT[2]

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[2]*School of Life & Environmental Sciences, Deakin University, Burwood*

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Abstract

The increasing demand for planned burning on public land will lead to more frequent use of fire in ecosystems where little is known about appropriate fire regimes, such as the Box-Ironbark forests in north-central Victoria. To investigate the impacts of planned burning on this ecosystem, a series of experimental burns were conducted during 2011 in two different seasons (autumn, spring) and at different levels of burn coverage. Bird community monitoring was undertaken to look at density and composition before and after burning. A focal species, the Scarlet Robin *Petroica boodang*, was selected and radio tracking used to investigate the direct impact of burning and changes in territory, habitat use and foraging behaviour following spring burns. Scarlet Robins proved to be quite resilient to high coverage burning of their habitat, remaining in areas of >90% burn coverage and canopy scorch, but there was an increase in extent of habitat used post-burn and some small shifts of territories. New nests were built in the post-burn landscape and two-thirds of tagged birds were found using the same territory one year post-burn. While bird community monitoring looks at overall changes, radio tracking provided some insight into the impacts of burning on individual birds. This highlighted the importance of adjacent unburnt forest for use as refuge during the fire, and other considerations such as abundance of invertebrates, breeding commitments and competition for territories, which may influence the response of Scarlet Robins.

Re-introducing fire into a long-unburned coastal woodland: changes in stand structure and composition

BENN ZEEMAN[1†], IAN LUNT[2] AND JOHN MORGAN[1]

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[2]*School of Environmental Science, Charles Sturt University*

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Abstract

At Ocean Grove Nature Reserve in Victoria, Australia, the stand structure of a long-unburned woodland has been documented in 1971 and 1996. These studies provide evidence that the original *Eucalyptus*-dominated woodland has been largely replaced by *Allocasuarina littoralis* in the long-absence of fire. *A. littoralis* is a fire-sensitive species and hence the re-introduction of fire may be a valuable management tool to re-instate the woodland structure. This study revisited the woodland in 2012. Since 1996, fire has been re-introduced into a portion of the Reserve (2006 and 2010). This study asked (I) in the continuing absence of fire, has *A. littoralis* continued to increase and *Eucalyptus* continued to decline? And (II) does the re-introduction of fire re-instate the woodland structure and composition? Since 1996, total tree density declined by 41% in the continued absence of fire (*A. littoralis* -34%, *Allocasuarina verticillata* +26%, *Acacia pycnantha* -78%, *Banksia marginata* -73%, *Eucalyptus* spp. -97%), and by 61% following fire (*A. littoralis* -57%, *A. verticillata* -44%, *A. pycnantha* -81%, *B. marginata* -81%, *Eucalyptus* spp. -84%). Total stand basal area declined by 37% following fire. However, in areas that had continued to remain unburned, the basal area of *A. littoralis* increased by 57%, and total stand basal area remained relatively stable. In the understorey, the frequency of prostrate native shrubs had substantially declined over the previous 40 years, while the re-introduction of fire did not lead to their recovery. This study identified the consolidation of *A. littoralis* dominance in the continued absence of fire, where declines in tree density have been compensated for through a substantial increase in basal area. The re-introduction of fire disrupted this process, opening up the woodland structure. However the re-introduction of fire did not reverse changes to woodland composition. The results of the study highlight both the value and limitations of re-introducing fire into long-unburned woodlands.

Linking Australia's Landscapes: lessons and opportunities from large-scale conservation networks

JAMES FITZSIMONS [1, 2], †, IAN PULSFORD[3] AND GEOFF WESCOTT[2]

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Abstract

Australia has seen a rapid growth in the establishment of networks of lands managed for connectivity conservation across tenures, at landscape and sub-continental scales. Such networks go under a variety of names, including biosphere reserves, biolinks, wildlife corridors and conservation management networks. Their establishment has varied from state government-led initiatives to those initiated by non-government organisations and interested landholders. As part of a new book, '*Linking Australia's Landscapes'*, we brought together the practical, on-ground experience of coordinators/facilitators of active large-scale conservation networks with those developing policy in this field as well as those researching social, governance and ecological aspects of these networks. In particular, we surveyed 14 existing major large-scale conservation initiatives for successes, failures and future directions and synthesised common themes. These themes included scale, the need for a shared and guiding vision, the importance of social and economic networks, leadership, governance, funding, conservation planning, the role of protected areas and communication. Policy development in this field in Australia has been somewhat ad hoc and we discuss the emergence of national policy relating to National Wildlife Corridors in Australia and the relationship of this policy to the long standing commitment to build a comprehensive, adequate and representative National Reserve System. Finally, we outline areas for further research for connectivity conservation initiatives in Australia.

Slopes to Summit (S2S); using a local landscape approach to achieve large-scale connectivity outcomes

PETER SPOONER

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Abstract

It is widely recognised that species ranges will need to shift with future climate changes, and this requires landscapes that are 'connected' allowing movements to occur. To achieve this aim, a number of large scale connectivity programs have commenced e.g. Great Eastern Ranges (GER). Slopes to Summit (S2S) is one of five regional partnerships of the Great Eastern Ranges Initiative (GER), one of the world's largest connectivity conservation programs. S2S was established in 2007; a regional partnership of land management and scientific research organisations that aims to achieve connection conservation outcomes in the NSW South Western Slopes Bioregion - a high priority area for biodiversity conservation. Priorities include various endangered box woodlands, native temperate grasslands, and over 58 threatened fauna and flora species, e.g. Squirrel Glider, which is the focus of on-ground connectivity conservation activities. Given that realised levels of funding are significantly less than what was required to achieve conservation at a large scale, a certain degree of strategic planning was required to target on-ground activities. In this presentation, I will describe the approach used by S2S to implement a large-scale connectivity program by (1) using available state-wide connectivity analyses to identify seven priority 'local landscapes', in conjunction with expert advice, (2) developing a conceptual approach to gain a better understanding of - *what is connectivity?* and (3) implementing a range of on-ground specific programs in local landscapes to achieve the broader aims. Obtaining funding from a range of sources, S2S is presently developing a range of new and exciting connectivity conservation initiatives, using research to help guide and evaluate on-ground decisions. An overview of S2S, highlighting some of the strengths and weakness of this large scale conservation initiative will be discussed, by providing examples of major successes, and details of new research to support such programs.

Managing and planning for conservation of the NSW stock route network

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Abstract

In NSW, stock routes have been a feature of the landscape since the mid-1800s. They were originally established to provide corridors of forage and shelter for livestock droving, and the habitat within them was left standing while other vegetation was broadly cleared to make way for agriculture. They now form excellent corridors for wildlife, but it is possible that some stock routes will be sold to private landholders because of issues associated with funding for management. We carried out a project that aimed to provide both evidence for the values of stock routes and advice on how to best manage and plan for them into the future. We demonstrate that stock routes play a considerable role in biodiversity conservation, recreation, tourism, preserving indigenous cultural heritage and as a stock refuge. They occupy fertile, low-lying areas of the landscape, and contain associated vegetation communities that have been preferentially cleared for agriculture and are under-represented in protected areas. To understand specifically how wildlife use the stock routes, we also surveyed woodland birds, wild bees, and insectivorous microbats in both stock routes and paddocks across central west NSW. Although responses differed between taxonomic groups, we show that both stock routes and scattered trees in paddocks had a consistent positive effect, and native pastures also form great habitat. Finally, we asked the question of how managers could decide which sections of the stock route network specifically should be prioritised for conservation actions such as protection and restoration. Using modern planning tools, we demonstrate how both connectivity and habitat quality can be incorporated into the planning process, and how priorities might change if you want to base conservation decisions on birds, bees or bats.

The Central Victorian Biolink initiative: harnessing and empowering the Landcare and conservation management network community to achieve whole-of-landscape conservation

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Abstract

Degradation and loss of biodiversity and ecosystem health continues in Victoria despite the substantial efforts that have gone into establishing a conservation reserve system and heightened natural resource management, over the last 20 or so years. Science is indicating that conservation efforts need to be up-scaled, to take into account landscape-scale patterns and processes and that we are moving into a period where climate-induced ecological changes will be widespread and significant. This brings into sharp focus that a whole-of-landscape approach is needed and the increasingly important role that the already existing strong networks of community groups will need to play in securing a resilient and healthy environment. The Central Victorian Biolinks initiative was born in 2012 as an alliance between 10 landcare and conservation management networks in the region to foster a collaborative, smart and up-scaled approach to achieve a major increase in effort to protect and enhance ecological processes and environmental values from the Grampians to the Alps and from Macedon Ranges to the Murray River. The project is developing a learning network to foster the sharing of existing knowledge and bring in new knowledge needed for best practice conservation, facilitating the development of collaborative projects between clusters of member networks focused on re-establishing functional connectivity and resilience to key major threats and building the knowledge base needed for local landcare and conservation networks to incorporate larger-scale ecological objectives into their action plans.

An approach for identifying habitat connectivity at regional scales

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Abstract

Small populations are encumbered with a suite of genetic and stochastic vulnerabilities that can ultimately lead to extinction. Identifying locations in landscapes that support connectivity to potentially ameliorate these outcomes is of interest to government and conservation agencies, as well as local interest groups. There are many software tools that been developed over several decades to support analyses of landscapes for connectivity. We reviewed a range of these tools / packages and evaluated more closely five of the most common methods in the context of their application to regional conservation planning across central Victoria. Methods examined include (1) Connectivity Analysis Toolkit (CAT), (2) Circuitscape (CCS), (3) Linkage Mapper (LM), (4) Universal Corridor (UNICOR), and (5) Conefor Sensinode 2.2 (CS22). We used tested these methods on 12 targeted taxa, including mammals, birds and reptiles, that display a variety of ecological characteristics and dispersal capabilities. In the subsequent part of this study we developed an approach that integrated several nested views of connectivity at species-specific scales over the whole landscape. Our intent was to i) use available software tools within a structured logic to form views of multi-scale species-specific connectivity and to then to ii) aggregate these in a multi-species view across the same landscape. These analyses used several processing options within ArcGIS, as well as the systematic conservation planning tool *Zonation*. For each species we considered i) the home range, ii) a conservative and iii) broader estimate of the species' gap crossing ability, iv) an estimate of the broader dispersal capabilities of the species and v) the longer-distance pathways identified from CCS analyses undertaken above. This combined approach has a number of strengths in its explicit structure and some weaknesses with data availability and computational processing.

Of mistletoe and mechanisms: a resource-based approach to identify drivers of woodland biodiversity

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Abstract

Rather than the habitat area, location or configuration, ecologists are increasingly focusing on resources to understand distribution patterns of plants and animals in fragmented, multifunctional landscapes. One resource considered to have a wide range of benefits to native wildlife is mistletoe, a group of parasitic native plants that provide food and shelter for a wide range of birds and marsupials. To measure the influence of mistletoe on diversity patterns in grassy box woodlands, a large-scale manipulation was performed across 40 remnants, removing all mistletoe from some woodlands while leaving others as controls. Three years after mistletoe removal, bird diversity was measured and compared with initial values. While bird diversity exhibited little change in the control woodlands (modest increases associated with post-drought recovery) the number of birds in treatment woodlands dropped by more than one third. Rather than those birds depending on mistletoe as a food source or nesting location, the group exhibiting the greatest decrease was ground foraging insectivores—many lost entirely from woodlands after mistletoe removal. This unexpected response can be explained by parallel research on parasitic plant litter, this patchy and highly enriched nutrient source boosting productivity, accelerating decomposition and promoting understorey diversity. These effects likely extend below ground to decomposer communities, resulting in greater numbers of more accessible prey items for ground-foraging insectivores; a bottom-up explanation consistent with the emerging view that declines in woodland birds reflect profound changes in productivity and soil health. In addition to exploring the applied implications of these research findings for birds, mistletoes and woodlands, I advocate the benefits of resource-based studies generally as a complement to conventional map-based approaches to natural resource management.

An audit of riparian restoration; following a restoration trajectory or meandering through a changed landscape?

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Abstract

Riparian ecosystems are amongst the most degraded systems in the landscape and there has been substantial investment in their restoration. To maximize environmental outcomes, there is an urgent need to develop the 'science' of restoration, and to move from small-scale implementation to application of knowledge at a broader landscape scale. Here we report on riparian restoration efforts in two regions of central and south-western Victoria, the Corangamite Catchment Management Area and the Glenelg Hopkins Catchment Management Area, focusing on tree and shrub structure and composition. Within each catchment, three age classes were identified; < 4, 4-8 and 8-12 years post-restoration, as well as pre-treatment sites. Reference (remnant) sites were used to determine whether there was evidence of a trajectory in vegetation development towards a historical reference state. We used 1750s Ecological Vegetation Classes (EVCs) to identify the vegetation thought most likely to be present at restoration sites, prior to disturbance. Post-restoration vegetation structure was well developed by 4-8 years and most restoration plots contained a broader selection of tree and shrub species than occurred within the mapped EVC for the site. Hence, most plots do not replicate historic reference states, instead containing a subset of the tree and shrub species present in remnant plots as well as species not found in remnant plots. Tree and shrub recruitment occurred in all remnant plots and in 40-50% of plots restored either 4-8 years ago, or more than 8 years ago. In all plots, *Acacia* species recruited more frequently than any other group, suggesting that *Acacia* species may dominate these sites in the long term. However, restoring to reference states may not be the desired objective in a changed landscape and plant community development is likely to occur over greater time-spans than those represented by the age of plots used in this study. Hence, if we are to understand how to restore ecological function, irrespective of the suite of species that comprise our restored landscapes, audits that encompass long-term monitoring are vital.

Restoration of ecosystem engineers affects habitat use by a key detritivore

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Abstract

Australia's recent ecological history has been characterised by fossorial marsupial (FM) declines, initiating nationwide reintroduction programs to conserve surviving species. However, recovery of biotic interactions and ecosystem functions damaged by declines are often assumed benefits of restoration. Ignorance of the effects that reintroduced species have upon persisting species undermines predictions of realised habitat sustainability and carrying capacity. The role of climate in modifying interactions can further complicate predictions, particularly in drier ecosystems where many FM species reintroductions occur. Some of the most threatened fossorial marsupials were ecosystem engineers, whose foraging had significant impacts upon the habitat use of soil-dwelling invertebrates. We compared habitat use by termites in landscapes where FM species were extinct, against landscapes where FM species were reintroduced, along an aridity gradient. Termites are key detritivores, and are sensitive to soil disturbances and predation by reintroduced FM species. Logically, reintroduced FM species must expose termites to soil disturbances and predation events distinct from those where FM species are extinct. We tested the hypothesis that FM presence would alter termite use of buried resources along an aridity gradient by using: 1) Paired resources measuring termite resource abandonment post-disturbance, and 2) Resources exposed to different levels of soil disturbance, measuring changes in termites' resource consumption. Termite responses to soil disturbance were also compared against a climatic gradient, testing the hypothesis that both abiotic and biotic factors interact when influencing termite behaviour. Termites both 1) abandoned disturbed resources in greater numbers, and 2) consumed lower proportions of frequently disturbed resources when reintroduced FM species were present. However, drier climates limited termite responses by restricting resources. We highlighted the importance of testing persisting species' responses to marsupial reintroductions: While reintroductions changed habitat use by key detritivores, their responses were also subject to climatic restrictions upon resource availability.

Riparian zone widths, restoration objectives and catchment land use: management guidelines

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Abstract

Intact riparian zones are universally acknowledged as critical to maintaining aquatic-terrestrial ecosystem function. Degradation of riparian zones is widespread and, by virtue of their interface role, adjacent waterways are invariably degraded. Riparian restoration is viewed as one step toward improving the condition of waterways and is usually undertaken by fencing off the stream to a fixed lateral width and planting vegetation. The current fixed width rationale arises due to practical constraints (i.e. riparian land tenure) and guidance by recommendations that lack strong supporting evidence. Here we compile information on riparian buffer widths from the literature, focusing on the evidence available to support widths required to achieve various biophysical objectives. Not surprisingly, the 'effective' riparian width varied among ecological objectives but most importantly, given a specific objective, it varied depending on landscape and site context. We focus on riparian systems in Victoria to highlight how these width data may form the basis for a decision support tool for land managers, with specific reference to incorporating information on site/landscape context. Recommended widths varied from 25m for improving water quality under low intensity land uses to well over 100m for increasing terrestrial riparian biodiversity under high intensity land uses. These recommendations were strongly influenced by the confidence with which data from different systems could be extrapolated to our case study area. Any consideration of the role of the riparian zone as a buffer from catchment disturbances needs to account for the landscape context and incorporate the acknowledged interdependencies between the two. In doing so, the management objective for protection and restoration must be clearly articulated, with full consideration being given to both sides of the channel, if restoration of riparian function is to be successful.

Community values for publicly managed natural land in Victoria

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Abstract

Human values are playing an increasingly important role in the planning and management of natural ecosystems. While the values of key stakeholders and local communities are relatively well understood by management organisations, the values of the general public are less well understood. This project developed a conceptual framework for understanding these values that links concepts of value relevant to managers and policymakers with theoretical understandings of value. This framework distinguishes between core human values that guide people's judgements of the world around them (such as social justice, wealth and intrinsic values for nature) and the valued attributes of nature (such as biodiversity, recreational opportunities and scenic beauty). A survey instrument to measure these values was developed, derived from existing psychometric scales (Stern's Environmental Value Orientation scale, and Winter's Natural Area Value Scale) and a newly created scale to measure valued attributes of natural land. A pilot study using the instrument was developed to compare public values across one of three randomly presented landscape contexts: all publicly managed natural land in Victoria, coastal areas, and large urban parks. A purposive snowball sample was used to recruit participants with a range of views and professional experience with land management. Factor analysis of responses (n=646) found core value concepts that were largely consistent with previously published studies. Valued attribute factors separated concepts relating to ecological attributes, social functions, personal benefits of nature, cultural attributes and high-impact uses. Valued attributes were rated similarly across all landscape contexts, although there were small but significant ($P<0.05$) differences between in the way people valued social functions (higher in urban parks) and productive uses (lower in urban parks). There were also significant relationships between people's core values and the attributes of publicly managed natural land they valued. The results of this study highlights that the values of the general public for publicly managed natural land are complex – different people value different kinds of natural areas in different ways. These results will be useful to policymakers by revealing why people value particular attributes of natural land.

Poster Abstracts

Spatial assessment and mapping of biodiversity and conservation priorities in a heavily modified and fragmented production landscape in north-central Victoria, Australia

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Abstract

Human impacts on the natural environment have resulted in a steady decline in biodiversity and associated ecosystem services. A major policy and management challenge is to efficiently allocate limited resources for nature conservation to maximize biodiversity benefits. Spatial assessment and mapping of biodiversity value plays a vital role in identifying key areas for conservation and establishing conservation priorities. This study measured biodiversity value using readily available data and tools in order to identify conservation priority sites in a heavily modified and fragmented production landscape. The study also assessed trade-offs among biodiversity and other ecosystem services. We used spatial tools for assessing and mapping biodiversity such as Patch Analyst in ArcGIS 10.2 to assess landscape alteration states, and the Integrated Valuation of Ecosystem Services and Tradeoffs to identify habitat quality. Results indicated that areas of high biodiversity conservation value were concentrated in less modified land-cover types. Substantially modified land-cover types (generally associated with agriculture and irrigated pastures) had lower habitat quality and biodiversity value. The analysis revealed that assessments based solely on habitat condition may not be the most suitable basis for conservation planning because this does not include associated adjacent land uses, roads or other threats to biodiversity. Spatially targeted environmental plantings and less intensive agroforestry that reconnect native remnants in heavily fragmented landscapes can provide significant potential conservation outcomes. Planned landscape reconfiguration based on readily available spatial data can yield net positive benefits to biodiversity by halting degradation of remnant native vegetation and increasing total habitat area.

Scientific input to government policy-making: a case study highlighting ecological processes

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Abstract

How can scientific knowledge and the 'accumulated wisdom' of experienced ecological scientists be efficiently gathered to inform government conservation policy-making? A two-part project was commissioned by an alliance of environmental non-government organisations in Victoria. A range of scientists, other relevant professionals and practitioners was consulted via workshops, extended interviews and discussion groups. Their views were compiled regarding the condition and importance of the ecological processes that sustain biodiversity in Victoria, and consequently the policy priorities for their management and conservation. The resultant reports distilled the findings as credible, well-informed and focussed input to preparation of the (previous) State Government's policy on biodiversity and land health. Benefits arising from the project included: 1) it stimulated new ways of thinking about conservation priorities in Victoria; 2) it fostered greater interaction among and between ecologists, policy analysts and conservation groups; and 3) the credibility of the recommendations was enhanced by both the breadth and reputation of those participating and the production of peer-reviewed publications.

How much bushfire is too much for Western Victoria's woodland birds?

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Abstract

Victoria's 2009 wildfires resulted in an increase in the levels of prescribed burning on public lands. The area of land now burnt is effectively double previous levels and will continue in this manner, irrespective of any wildfires. In the past we have seen prescribed burning occurring seasonally - now it is carried out all year. What impacts will this have on the woodland avifauna? Woodland birds are, in southeastern Australia, already declining. Negatively impacted by urban development and the effects of climate change, changes to fire regimes are likely to add further pressure. Frequent fire may result in vegetation species and density changes. This may impact on birds with vegetation dependence for food or nesting sites. Post-fire new growth vegetation in a woodland results in a relatively dense understory for a period. If this state is permanently maintained, what will this mean for those birds that normally inhabit open woodlands? If trees have permanent bark burn, what will this mean for birds that feed from the bark layer? Few studies have considered the effects of increasing bushfire frequency on avifauna. Bird monitoring is currently underway on 84 sites in Western Victorian woodlands. From Linton in the west to the Brisbane Ranges in the southeast, these sites are nested in 14 mosaics, with different fire histories. The project will survey the bird communities and will test predictions of the impact of fire on birds and their habitats, considering time since fire, fire type (planned vs wildfire), as well as pre- and post-burn comparisons.

Our forgotten flora.
Characterising Mt. Helen's bryophytes.

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Abstract

Bryophytes, which include mosses, hornworts and liverworts, are non-vascular plants. Despite their small stature, they are of great ecological importance, yet their study has been hampered until recently by a dearth of comprehensive and current identification guides. The Ballarat region is scarcely documented. The flora list for the University of Ballarat's Mt. Helen campus omits bryophytes and no management plans consider them. A species list was compiled for the campus and assessments were made of habitat preferences, status and conservation needs.

Bryophytes were collected widely across campus and their use of substrates and habitats was recorded. Species were identified under a dissecting microscope. Each was assigned to a growth form and life cycle strategy and was recorded as either native or introduced.

Forty two species were found, of which eight were exotic (six mosses and two liverworts). In total, 14 species were liverworts (representing four families) and 28 species were mosses (in six families). Developed areas of campus held more species (37) than remnant forested areas (26). In forests, pleurocarpous (spreading) mosses and leafy liverworts predominated, with many long-lived species on durable surfaces such as rocks, trunks and logs. Forests tended to feature mostly native species with low spore production. Many were on steep or vertical sites or avoided burial in leaf litter by being tall and resistant to leaf lodgement.

In developed and open areas, acrocarpous (upright, tufted) mosses were the most species rich. Bryophytes of disturbed areas were mostly ground-dwelling, drought-resistant mosses that formed dense turfs, though some were water-storing fleshy liverworts and others were stone- and cement-dwelling species that tolerate exposure. Many species from disturbed sites produced asexual propagules (buds, gemmae, tubers, etc.) as well as numerous spores. In exposed open sites short-lived or ephemeral colonists and pioneer species abounded, as did drought-resistant growth forms such as dense mats and low cushions. In contrast, exotic pleurocarps formed extensive rough mats (with both horizontal and vertical stems) in sheltered, damp long grass.

Sites that were species rich included a sunny west-facing sandstone/slate cutting in East Terrace that is seasonally dampened by seepage. A south-facing and shaded road cutting in Gear Avenue has a shade-tolerant complement of species that also experiences seepage. Desiccation-intolerant bryophytes such as filmy liverworts were rare on campus and confined to very moist and sheltered microhabitats, particularly moist forested gullies and the substantial stem-drainage lines on large eucalypts. These all merit consideration in conservation planning for the campus.

Physiological ecology and dispersal of *Pomaderris vacciniifolia*; towards an explanation of why this species is threatened

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Abstract

Aspects of the physiological ecology and dispersal traits of *Pomaderris vacciniifolia*—a vulnerable Victorian endemic shrub—were examined to identify their influence on the decline of populations. The response of seed germination to disturbance (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^{O}C heat treatment to seeds while smoke exposure and light intensity had little influence. The findings indicate a likely positive post-fire germination response. Unaided seed dispersal is limited, which explains in part the species' apparent reduction in area of occupancy. These findings contribute to a broader research project examining the ecology of this species and development of management prescriptions for its conservation.