

# Biodiversity Across the Borders

Conference Program and Abstracts

Centre for Environmental Management

University of Ballarat

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**Centre for  
Environmental  
Management**

# **Biodiversity Across the Borders Conference Program and Abstracts**

**Edited by** S. K. Florentine, G. A. Ambrose & M. E. Westbrooke

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## **Symposium Abstracts**

## **The frailties of expert judgments in conservation risk assessments**

Mark A. Burgman

School of Botany, University of Melbourne, Melbourne, Victoria 3000

### **Abstract**

Conservation biologists and environmental managers are required to make decisions before full knowledge is available. Often the time frames and level of understanding are such that we rely on expert judgement. Experts provide the bulk of the scientific input for conservation listing decisions and for environmental risk assessments. Conservation biology shares this with other professions, including nuclear engineering, epidemiology and hydrogeology. Their experience provides some interesting lessons. Expert judgements are error prone because of psychological perception, motivational bias, and overconfidence. Given the necessity for expert judgement, conservation biologists should be trained to deal with their personal frailties.

## The impact of grazing on perennial species richness in Belah (*Casuarina pauper*) Woodland

Martin E. Westbrooke

Centre for Environmental Management, School of Science & Engineering, University of Ballarat, PO Box 663, Vic. 3353.

### Abstract

Two hundred *Casuarina pauper* woodland sites from pastoral leases and conservation reserves in NSW, SA and Victoria were assessed to determine community structure and floristics. Perennial species occurring were recorded together with a cover abundance value based on a modified Braun-Blanquet scale. At each site, evidence of grazing by sheep and rabbits, length of grazing history, time since reservation and distance from water was also recorded and assigned ordinal classes or values. The distance to the nearest permanent or semi-permanent water source for stock was determined from on-ground observation, reference to maps and analysis of a Landsat TM image obtained following very high rainfall in the area in 1992-93. A palatability rating for all perennial species was also developed based on assessments of palatability of adult plants by a number of authors. Seventy-five perennial species were recorded from the 200 study sites. Stepwise multi-variate regression was used to give an understanding of the site variables most important in determining perennial species richness. Analysis yielded a regression equation with three steps accounting for 75% of the variance in species richness -  $SR = 19.1 + 3.3 \times DIS - 2.8 \times RAB - 7.7 \times RES$  ( $r^2 = 75.3$ ,  $p = <0.001$ ). This infers that species richness will increase with distance from water and time since reservation but decrease with increased rabbit grazing. There was a clear relationship between perennial species richness and distance from water ( $r = 0.7378$ ). Total grazing pressure including impact of sheep, rabbits, macropods and goats is difficult to determine for the present and is at best speculative for the past. Stocking rates on pastoral leases, even where available, are at a paddock level and the grazing pressure may vary considerably across the paddock. Available water has a strong influence on grazing pressure. The distance from the nearest permanent or semi-permanent water was determined as the best surrogate measure of long-term grazing pressure. Based on the presence absence data and palatability rating a list of key indicator species for the community was derived.

## Gypsophily in arid and semi-arid south-east Australia

Marion J. O'Keefe

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### Abstract

The vegetation associated with outcrops of gypsum in arid and semi-arid regions of Australia has received little attention. Plants associated with gypsum are referred to as gypsophiles, while gypsophily refers to the ability of a plant to tolerate gypsum. Significant deposits of gypsum (hydrated calcium sulphate) occur in Victoria, South Australia, Western Australia, Northern Territory and New South Wales, where mean annual rainfall is less than 400 mm. Many otherwise widespread species are not recorded on gypsum soils, which have been classified as floristically poor. This suggests that gypsum has an adverse effect on most plant species. What this effect is, and how some plants have become adapted to it, form the basis of this research. To understand gypsophily, both the benefits and disadvantages of the gypsum substrate must be investigated. This research is important for: the appropriate management of vulnerable or threatened taxa that have a known association with gypsum and the appropriate rehabilitation of commercial gypsum mines following suspension of mining operations. Fleshy Minuria (*Kippistia suaedifolia*) from the family Asteraceae provides an opportunity to investigate the ecology of gypsophiles in Australia. An apparently obligate gypsophile, *K. suaedifolia* is endangered in NSW and considered vulnerable in Victoria. However, preliminary studies have revealed a population of almost 100 000 plants on exposed gypsum at an abandoned gypsum mine in the Raak Plain, north-west Victoria and close to a million plants at another abandoned mine in Ivanhoe, NSW. This latter site is one of only three known occurrences in NSW. It is important to identify and survey potential habitat for gypsophiles. The flora associated with these sites will be analysed and laboratory and greenhouse trials will determine the soil tolerances and reproductive ecology of *K. suaedifolia* and other gypsophiles.

## **Sex after all: the conservation genetics of *Casuarina pauper* and *Allocasuarina luehmannii* from semi-arid Victoria**

Fiona A. Murdoch

Centre for Environmental Management, School of Science & Engineering, University of Ballarat, PO Box 663, Vic. 3353.

### **Abstract**

Conservation genetics provides information on mating systems, genetic variation and the likely impact of restoration activities on plant species. *Allocasuarina luehmannii* and *Casuarina pauper* are primarily dioecious trees with wind-dispersed pollen and seeds. Because seedling recruitment is limited, root suckering is believed to be an important mode of recruitment in these species and a possible tool for restoration. This study examined the genetic structure of three mature woodlands of each species. Amplified Fragment Length Polymorphisms (AFLPs) were used to determine whether clonal individuals exist in stands of mature trees and to provide estimates of genetic variation within and between populations. No clonal individuals were detected in the AFLP products obtained from 82 individuals of *A. luehmannii* or from 65 individuals of *C. pauper*. Genetic variation was high for both species (Shannon's Index: 0.28 and 0.35 respectively) with 94% and 87% respectively of the variation occurring within populations. This implies that in the past, root suckers have had little if any impact on the recruitment dynamics of these species. The present day occurrence of young root suckers in these populations is most likely because the frequency of disturbance resulting in root suckers is more common now than it was historically. The proportion of genetic diversity held within populations indicates a high level of gene flow. This suggests that introducing clonal genotypes into existing populations is unlikely to impact negatively on the population genetics of these species and may have positive impacts.

## **Rainfall-driven episodic flood events: are they a major factor in moulding Australian arid land vegetation patterns?**

Singarayer K. Florentine & Martin E. Westbrooke

Centre for Environmental Management, School of Science & Engineering, University of Ballarat, PO Box 663, Vic. 3353.

### **Abstract**

Episodic high rainfall events have been proposed as a significant factor in perennial species recruitment but flooding based on rainfall at a distance from the site has received little attention. Although such flood events in arid Australia may only occur once in 100 years or more, studies of the ephemeral Olary Creek, which flows from South Australia into New South Wales, indicate that occasional floods can also have a significant impact on the vegetation and landscape. During February 1997, an extreme rainfall event caused flooding in the Olary Creek and inundated its flood plain. One branch of the creek created a terminal lake within mallee vegetation on Nagaela Station, far western New South Wales. The flood path of Olary Creek and this terminal lake provide an opportunity to study the role of rainfall-driven flood events in shaping vegetation in arid environments. This paper reports (i) the response of arid land plant species to high rainfall-driven episodic flood events and (ii) how grazing pressure from native and introduced herbivores can impact on native species response. A study of the botanical composition in flooded and control areas shows that species richness in the flooded area was twice that of unflooded areas. In particular 27 native species from 13 families were recorded in enclosed and open plots located on the flooded area. Over the study period nine species: *Brachyscome ciliaris*, *Helichrysum leucopsidium*, *Vittadinia cuneata*, *Casuarina pauper*, *Maireana sedifloia*, *Salsola kali*, *Sclerolaena obliquicuspis*, *Eremophila sturtii* and *Eucalyptus foecunda* germinated only in the flooded enclosed plots. Further, eleven exotic species from five families were recorded in the flooded (both enclosed and open) plots. The South American shrub *Nicotiana glauca* invaded a large part of the lake and extended into the surrounding mallee shrubland. It is concluded that rainfall driven flooding events trigger changes in arid land vegetation communities, but the influence of grazing and weed invasion may further influence long lived perennial species.

## The value of scattered paddock trees in rural landscapes as foraging and roosting habitat for insectivorous bats in south-eastern Australia

Lindy F. Lumsden<sup>a,b</sup> & Andrew F. Bennett<sup>a</sup>

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<sup>b</sup>Arthur Rylah Institute, Dept. Sustainability and Environment, PO Box 137, Heidelberg Vic. 3084.

### Abstract

Paddock trees and small patches of remnant vegetation often comprise a significant proportion of the remaining native vegetation in rural landscapes. Despite legislated clearance controls, these trees continue to be lost by clearing, dieback and senescence. Due to their mobility, insectivorous bats are one group able to take advantage of these scattered resources. However, little is known of the relationship between tree density and bat activity, and the impact of an incremental loss of trees. To investigate this issue, bats were sampled at 30 sites in five categories of tree density, ranging from remnant blocks (> 35 trees/ha) to sparsely scattered trees (< 1 tree/ha) in the Riverina region of northern Victoria and southern NSW. Open paddocks devoid of trees were also sampled to determine the importance of trees in the landscape. Bats were sampled using harp traps and Anabat ultrasonic bat detectors. Bats were widespread throughout all categories and all species were recorded amongst sparsely scattered paddock trees. There were no significant differences between the four treed categories in overall bat activity. The highest levels of activity were at 20-30 trees/ha, similar to pre-European settlement tree densities for this environment. Open paddocks had lower levels of activity and a different community composition. Although activity levels were similar around an isolated tree and a tree within a denser block of vegetation, trapping data suggests that on a site basis, as the density of trees decreases so too does the abundance of bats. Scattered trees were also used extensively as roost sites. Radio-tracking revealed that approximately one-third of roost sites used by two species (Lesser Long-eared Bat and Gould's Wattled Bat) were in scattered trees, with the remainder in remnant blocks. Some roost trees were more than 200 m from other remnant vegetation. This study highlights the value of even the smallest remnant of native vegetation (i.e. a single tree) as foraging and roosting habitat for bats in heavily fragmented rural landscapes.

## Automated identification of bat calls

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### Abstract

In recent years, ultrasonic detectors have become widely used to survey insectivorous bats by recording high frequency echolocation signals emitted by bats for navigation and locating prey. It is now possible to simultaneously record bat calls for extended periods onto data loggers, resulting in the collection of vast quantities of data. Until recently, these data were analysed by individually examining each call sequence and subjectively assigning the call to a particular species (or species group) by comparison with reference calls. For most research projects, this process typically requires weeks or months of work. The research reported here involves the development and testing of a user friendly software system, called AnaScheme, for rapidly and objectively identifying ultrasonic bat calls. While flying, bats continually emit a series of discrete signal pulses. AnaScheme identifies the pulses to species (or species group) level by extracting a range of numeric parameters from each pulse, using a polynomial curve fitting algorithm, and subjecting the resulting information to a customisable digital identification key. The user interface of AnaScheme is constructed in the C++ programming language, resulting in a high quality, user-friendly interface. The analytical component of the program utilizes an embedded scripting language (Python), to enable identification keys to be developed and modified by end-users. The flexible nature of the Python identification keys enables a range of methods to be used to distinguish different groups of species. For example, simple dichotomous key steps are sufficient to identify highly distinguishable species, but species with similar or overlapping call characteristics may be best distinguished using multivariate techniques including discriminant functions and neural networks. While research and development continues, the system is being used and evaluated by bat researchers throughout Australia. Testing to date has shown that the use of carefully designed keys results in little incorrect identification, and a large proportion of calls being identified.

## **Spatial use of forest habitat by foraging microbats: a field-based experiment (work in progress)**

Patrick T. Prevett

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### **Abstract**

Changes in tree density and canopy cover relating to forest management create significant changes to forest environments that persist for several years. What are the responses by microbats to these disturbances? Descriptive studies, where the ecological attributes of disturbed and undisturbed forest patches are measured, are helpful in providing information on the nature of general microbat foraging preferences. However, this approach does not provide direct behavioural data of bats making choices between different habitat types. If such data could be obtained, they would strengthen conclusions based on the descriptive studies. A simulation experiment is proposed, based on the concept of a clutterbox. A three dimensional clutterbox cube of appropriate dimensions will be constructed above a fire dam in the Wombat State Forest. The clutterbox will consist of parallel lines of baling twine hanging from a net located above the dam. Trees next to the fire dam will support the clutter. Pre, during and post-clutter assessment of bat activity will be determined simultaneously using Anabat detectors, both at the clutterbox site and at a second fire dam site a short distance away. The second site will not be 'cluttered' and will act as a control, operating at the same time as the experimental set-up. The time allowed for data collection pre, during and post-trials will be seven days for each period of the trial. After three weeks of testing the arrangements will be reversed so that fire dam one becomes the experimental site and fire dam two becomes the control, giving one level of replication. In addition to Anabat monitoring, data on the flight behaviour of bats in the vicinity of the clutterbox and control sites will be collected using a night-scope and infra-red illumination invisible to the bats. The clutter to space ratio is under the control of the researcher, allowing a number of clutter densities to be applied to the clutterbox. This will permit aversion thresholds to clutter to be measured for different species of bats. Insect light traps at the experimental and control sites will provide information on the density and abundance of insects at both sites during the course of the study to demonstrate whether prey density and diversity are similar in the clutterbox and control situations.

# Fire and hollow formation in the Warby Range State Park

Mathew F. Adkins

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## Abstract

Hollows are an important, but rare, resource for many vertebrate species in the Box Ironbark forests of central Victoria. There is limited knowledge of the hollow formation process within these forests and therefore limited options for hollow recruitment. In this study I assessed the external features of burnt and unburnt trees to determine the influence of fire on hollow formation in Box Ironbark eucalypts. A total of 130 Mugga Ironbark (*Eucalyptus sideroxylon*) and 29 Red Stringybark (*E. macrorhyncha*) trees in burnt and unburnt patches were externally assessed for the number of hollows, scars, dead branches, branch stubs and epicormic knobs along 90 m transects (two within burnt area/ two in non-burnt). Using the point-centred quarter technique, the four nearest trees were visually assessed every 10 m. A significantly greater proportion of trees in burnt areas had scars than trees in unburnt areas ( $P= 0.05$ ). Within burnt areas, Red Stringybark trees were more likely to contain a scar as were trees of smaller diameter. However, significantly greater numbers of dead branches and branch stubs occurred within both burnt and unburnt areas than scars. Fire had less influence on the number of small, medium, large and very large branches than tree diameter, with significant differences found between tree diameter size classes for all branch sizes. No significant differences were found between trees in burnt and unburnt areas for the number of hollows or epicormic knobs. The results indicate that for hollows either 14 years is not long enough for visible differences between burnt and unburnt trees to become apparent or that this particular fire did not alter the hollow formation process. The lack of difference in epicormic knobs numbers between burnt and unburnt trees may indicate that the fire was not particularly intense and therefore did not influence hollow formation as much as more intense fires. The greater number of scars in burnt trees might eventually lead to differences in hollow numbers between burnt and unburnt trees however, the most common type of dead wood within trees were dead branches and branch stubs which did not differ significantly between burnt and unburnt trees. Size of tree had a greater influence on hollow formation potential if we consider the mean number of branches within a tree and the distribution of branch size. Large trees not only had bigger branches but also greater number of each branch size class than smaller size classes. Based on external assessment. It appears that within this area of the Warby Range State Park tree size has a greater influence on hollow formation than fire.

## **Characterisation and modelling of Brolga (*Grus rubicundus*) flocking habitat in South-western Victoria**

Rebecca A. Sheldon

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### **Abstract**

The Brolga is listed as a vulnerable species in Victoria. The south-west Victorian population is thought to be discrete, and uncertainty surrounds its current demographics. Previous habitat characterisation studies for the species have focused almost exclusively on breeding habitat. A systematic assessment of flocking habitat is lacking and that described in the literature is based largely on descriptive observations. Major aims of this study were to identify, characterise and potentially model Brolga flocking habitat across south-western Victoria. Data obtained from field measurements and spatial information solicited from a Geographic Information System (GIS) were combined to achieve this. Flocking sites were identified through the compilation of existing records into a comprehensive database. Resultant mapping of sites enabled data to be obtained for relevant spatial variables. Twenty-nine wetland flocking sites were selected for analysis. Data for multiple variables were statistically analysed to characterise flocking habitat. Contributor variables were identified via multiple regression analysis and the potential for modelling from these variables was investigated. Preliminary results were consistent with the literature and suggest that wetlands used by flocking Brolga consist of deep freshwater marsh or permanent open saline/fresh water. Wetland sites are generally greater than 30 hectares in area (82%) and have more than one water source (86%). Surrounding landuse within a five-kilometre buffer was predominately grazing (65%) and cropping (21%). Regression and modelling results are still being analysed and will be presented and discussed at the conference.

## Does size matter? Tree use by translocated Koalas

Flavia Santamaria<sup>a,d</sup>, Marie R. Keatley<sup>a,b</sup> & Rolf Schlagloth<sup>c</sup>

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### Abstract

Koalas were introduced to French Island around the 1900s. Rapid population growth resulting from a lack of predation, disease and dispersion opportunities as well as the lack of a variety of tree food species caused over-browsing of *Eucalyptus viminalis* and *E. ovata*. Since the early 1930s koalas have been translocated from French Island to re-establish the species on the mainland and alleviate over-browsing of trees at the source site. A 2.5 year study of 30 translocated koalas examined, amongst other issues, tree use at the release forests where the abundance of *E. viminalis* is low and a variety of tree species is available. Koalas were released into three forests in the Ballarat area (Creswick State Forest and Park, Enfield State Forest and Lal Lal) and radio-tracked for 26 months. Tree species and tree sizes used were recorded. The Point-Quarter Sampling method was used to survey those areas in the three release forests where koalas were found. Koala location were compared to the species and sizes of trees used by the monitored animals. Seven species were surveyed in the three forests. DBHOB was not significantly different amongst species and forests. Even though koalas used 20 tree species, for the purpose of this paper only those species also found in the survey were used in the analyses. DBHOB of trees used by the koalas was not significantly different amongst forests but was different amongst species. Further analyses show that the mean size of the trees used by the koalas was greater than the mean size of trees available in the release forests. Koalas will use a wide variety of tree species if available and show a preference for larger trees.

# **Conservation of woodland insects in the Wimmera area of Western Victoria**

Fabian Douglas

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## **Abstract**

Widespread clearing of native vegetation for agriculture in the Wimmera area of western Victoria has caused woodland and grassy woodland habitats to become fragmented. This in turn has had a significant (and usually negative) impact on the distributions and local abundance of the indigenous insect species that are associated with these habitats. This presentation will highlight the integral role that the resident insect fauna plays in the ecological processes of threatened woodland habitats. It will also emphasize the importance of conserving the diversity of insects that occur within the remnants of woodland and grassy woodland in the Wimmera area. A series of management actions will be suggested that would allow for the long-term conservation of as wide a spectrum of insect species as possible. This will be followed by a discussion on the biology of some typical woodland and grassy woodland insects. The presentation is based on conclusions reached about the conservation and management of woodland insects after eighteen years of entomological studies and surveys in the Wimmera area.

## **Vegetation condition assessment of semi arid woodlands: alternative approaches**

Kate E. Callister, Martin E. Westbrooke, Stacey A. Gowans & Matthew S. Gibson

Centre for Environmental Management, School of Science & Engineering, University of Ballarat, PO Box 663, Vic. 3353.

### **Abstract**

Vegetation condition assessments are increasingly being undertaken in Victoria. Previous assessments of land managed for conservation have focused on field techniques. This study compared field survey techniques with remote sensing approaches to vegetation condition assessment of *Casuarina pauper* (Belah) woodland in northwest Victoria. Methods investigated were Landsat imagery, aerial photography and the treeden25 GIS map layer produced by Department of Sustainability and Environment, Victoria. Classification of three broad vegetation condition classes was tested initially, however, only two condition classes (good and poor) were reliably mapped using the remote techniques investigated (overall accuracy 87.1 – 94.9%). Whilst field techniques gave a greater level of differentiation at survey sites, when interpolated in broad classes across the study area, maps were no more accurate. Restricting the condition information to broad classes resulted in classification errors around the class boundaries. To minimise these problems, vegetation indices were investigated. The normalised differential vegetation index (NDVI) was found to be highly correlated with many of the field condition parameters, including the field vegetation condition index (0.81), percent cover of perennial species (0.78), and tall shrub species richness (0.65). Classification errors were avoided by measuring condition on a continuous scale. Total costs of remote condition assessment were similar to that of the field-based survey with the exception of the treeden25 layer. Use of remotely sensed data is unlikely to result in any significant cost savings over field assessment because of the need for ground truthing, purchase of remote data, and time for data analysis. However, the greater flexibility of remote assessment and the ability to detect change across the entire study area makes satellite imagery a useful technique for vegetation condition assessment. Vegetation indices appear promising for remote assessment of vegetation condition in the study area. However, the broad-scale nature of this data suggests that remote sensing of vegetation condition is likely to be most useful in conjunction with field survey.

## **Vegetation condition assessment of semi arid woodlands: a case study in Murray-Sunset National Park, Victoria**

Stacey A. Gowans, Martin E. Westbrooke, Kate E. Callister & Matthew S. Gibson

Centre for Environmental Management, School of Science & Engineering, University of Ballarat, PO Box 663, Vic. 3353.

### **Abstract**

Belah (*Casuarina pauper*) and Pine-Buloke (*Callitris gracilis-Allocasuarina luehmannii*) woodlands in Murray-Sunset National Park have been degraded by the removal of overstorey species and long-term elevated grazing pressure. Despite a reduction in grazing pressure since the Park was reserved in 1991, there has been concern regarding limited perennial species regeneration. The Mallee Parks Management Plan identified the need to monitor the condition of these woodland communities. In December 2000, floristic and structural data were recorded from 115 quadrats across the Park within Belah and Pine-Buloke woodland. For each quadrat, six parameters (native perennial species richness, native shrub cover, regeneration of native shrub species, strata intactness, tree condition, and overstorey age classes) were scored relative to benchmark values sourced from reference sites. A condition index on a scale of zero to one was calculated for each quadrat and woodland community from the parameter scores. A condition index map was generated from the quadrat condition indices using an interpolation technique. The condition index for both Belah and Pine-Buloke woodland was consistently higher in the reference sites (0.75 and 0.79 respectively) than in sites within the Park (0.37 and 0.41 respectively). The woodlands in the Park were typified by low perennial species diversity, recruitment and cover. Trees were generally healthy although the number of tree age classes present was typically low. These data provide a foundation for future monitoring of vegetation condition change within these woodland communities.

## Strategic assessment of fragmentation of parks and reserves by roads and tracks

Robert G. Milne<sup>a</sup>, Matthew S. Gibson<sup>a</sup> & John R Wright<sup>b</sup>

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<sup>b</sup>National Parks and Strategy Division, Parks Victoria.

### Abstract

Most Victorian parks and reserves contain a network of roads and tracks that provide vehicle access for visitors, managers and emergency services. Roads and tracks within parks and reserves can affect environmental values through various mechanisms such as removal of native vegetation cover, isolation of fauna habitat, dispersal of pest plants and animals and the alteration of microclimates along edges. To better understand the management implications of the current road and track network, Parks Victoria has commissioned a series of studies that will provide information on the extent of fragmentation of parks and reserves by roads and tracks, and the impact of fragmentation by roads and tracks on environmental values. A method to determine the level of fragmentation of parks and reserves by vehicular roads and tracks was developed for the first stage of the project. A process was then developed for investigating environmental risks and values in relation to fragmentation. Parks and reserves listed under the *National Parks Act 1975* and the River Murray Reserve were assessed. A Geographic Information System (GIS) was used to analyse spatial datasets including the parks and reserves layer and the state-wide road layer. Automated GIS processing, using the road and park spatial datasets, was developed to calculate park, road, and fragment parameters for each park. Maps were produced for each park that showed the size and distribution of fragments created by roads and tracks. Data produced by the GIS analysis were incorporated into a relational database and an automated reporting system was developed to collate the above information for each park or reserve into a 'Park Profile'. The parks and reserves were ranked by size, shape, road and track density and fragment density. Further GIS analysis was then undertaken using the fragmentation dataset and environmental datasets, including the state-wide Ecological Vegetation Class layer (EVC100\_BCS), the Flora Information System and the Atlas of Victorian Wildlife. The analysis produced information for each park and reserve on the occurrence of environmental values and threats in relation to fragmentation levels. The information produced by this study will be used to improve Parks Victoria's understanding of the environmental implications of roads and tracks within Victorian parks and reserves.

## ***Phytophthora cinnamomi* dieback in parks and reserves across Victoria**

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### **Abstract**

The plant pathogen *Phytophthora cinnamomi* has been identified as a “key threatening process” in the Australian environment. The threatening process is the lethal epidemic of ‘*Phytophthora* dieback’ that occurs when a combination of plant species susceptibility, presence of the fungal pathogen and vulnerability due to favourable environments leads to a major disruption of plant community structure. This study aimed to provide a strategic overview of the status of *P. cinnamomi* within parks, the distribution of flora and fauna species considered susceptible to the pathogen and the potential risk to the park and reserve network. A literature review was conducted to summarise the ecology of the pathogen and to aid in the compilation of a database of sites where *P. cinnamomi* testing has been conducted. A list of species considered susceptible to *P. cinnamomi* was also compiled, and the distribution of these species was extracted from the Victorian Flora Information System (FIS) database. These records were examined spatially, in terms of their occurrence in parks, and in relation to environmental variables including elevation, annual rainfall, and the density of roads and tracks. Using this information, risk classes were determined and mapped across the park network. Investigation of climatic and topographic parameters indicated that conditions are suitable for the pathogen to potentially occur over a large proportion (60%) of Victoria. It is known to be present in a significant proportion of the parks that occur within climatically suitable areas. High numbers of susceptible flora species were recorded in several parks including the Grampians National Park, Anglesea Heathlands, Angahook-Lorne State Park, Wilsons Promontory National Park, most parks within East Gippsland, and several parks in far south-western Victoria. These parks and regions typically support heathlands and heathy woodlands likely to contain a range of flora species considered susceptible to the pathogen. Approximately 40% (by area) of Parks have a climate and elevation within the range required for *Phytophthora* dieback and 13% of the Victorian park estate was classified as high risk. This project represents the first state-wide study of the distribution and risk of *Phytophthora* dieback throughout Victorian parks. Further investigation of risk assessment approaches is required, particularly following improvements in the availability of relevant state-wide datasets, and in our understanding of the requirements of the pathogen and the susceptibility of flora species.

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## Poster Abstracts

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## Habitat use by mammals and the impact of logging in the Wombat State Forest

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### Abstract

Silvicultural systems used in Victoria vary between forest types, along with the variety of mammal species and their habitat use. Compared to high elevation Mountain Ash forest, very little research has been done on the effects of logging on fauna and habitat values in the drier open foothill forest of Central Victoria. This research aims to assess the differences in the species composition and abundance of mammals between logged and unlogged sites and to correlate these with habitat parameters. Small mammals were sampled using Elliott trapping, hairtubes and nestboxes, while medium to large mammals were detected using transect counts and soil plots. Habitat was described and quantified using measures include basal area, species richness and cover abundance of vegetation and ground cover. Four small mammal species were detected: *Rattus fuscipes*, *Antechinus agilis*, *Acrobates pygmaeus* and *Petaurus breviceps*. Medium to large arboreal mammals detected included *Pseudocheirus peregrinus*, *Trichosurus vulpecula* and *Phascolarctos cinereus*. Medium to large ground dwellers included *Wallabia bicolor*, *Macropus giganteus*, *Vombatus ursinus* and *Felis catus*. Preliminary results suggest that species such as *R. fuscipes* are favoured by some stages of habitat development following logging. Other species, such as *A. agilis*, appear less abundant in recently logged sites. Arboreal marsupials are low in abundance throughout, which may reflect the relatively young age of the forest.

## Willow influences on aquatic habitat in the Yarrowee River, Ballarat

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### Abstract

The present study is part of a group of projects conducted the University of Ballarat that focus on willows along the Yarrowee stream continuum. The Yarrowee River and its catchment are highly modified. Its gold mining, engineering works and urbanisation have altered riparian zone structure and vegetation. A pervasive effect of urbanisation is an increase in the impervious surface cover of the zone, which has ultimately altered the hydrology and geomorphology of the stream. Willows are recognised for their high resistance to erosion and high sediment retention rates under erosive conditions, yet the consequences of these attributes for habitat formation in urban streams are poorly understood. The association between riparian vegetation and in-stream habitats was mapped along 11 km of the Yarrowee River, Ballarat including reaches with high densities of native riparian species such as *Eucalyptus viminalis*, *E. rubida*, *E. obliqua* and *Acacia melanoxylon* and reaches dominated by Crack willows (*Salix fragilis* var. *fragilis*). Distinctive geomorphologic features such as pool and riffle sequences and bedrock outcrops were found in association with native and exotic species. Almost all pools were associated with willows. In an attempt to establish a causal mechanism for the observed association, sediment profiles were mapped along random reaches. Willows captured greater amounts of sediment than native species and willow root mats bound the sediment into erosion resistant 'wers', which defined the downstream edge of pools. The restoration of a pool-riffle sequence is generally seen as a desirable attribute of river restoration. Willows are Weeds of National Significance yet they appear to create potentially desirable in-stream habitat. Consequently, willow management becomes complex. Desirable riparian vegetation outcomes such as the replacement of willows with native seedlings may have produced undesirable stream geomorphology outcomes.

## Age distribution of willows along urban and rural stream reaches

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### Abstract

Superficially, willows form similar stands along urban and rural streams in Victoria that appear to be monocultures of apparently even-aged trees. However, patterns of disturbance are likely to be different in intensively managed reaches of urban streams than in unmanaged rural streams. It was predicted that rural streams would differ in their recruitment pattern from urban streams because of these differences. This study explored whether urban and rural willow stands are demographically different. Age class distributions of Crack Willow (*Salix fragilis* var. *fragilis*) were obtained from riparian zones of the urban Yarrowee River that were subjected to substantial disturbance pressures and outside of Ballarat at semi-rural sites with mid-level disturbance. Demographics at Spring Creek, Hepburn Springs, were also evaluated as an example of a rural low-level disturbance site that was within a protected area, Hepburn Regional Park. The relationship between size (diameter at breast height, DBH) and the age of individuals was investigated to determine whether DBH provided an accurate surrogate measure of individual age. Age of individuals was determined by dendrochronological analysis of tree growth rings obtained from core samples using a 5mm increment borer. The relationship between age and size was determined through correlation analysis. Crossdating of ring chronologies was difficult because of the uniformity of ring widths. The mean growth rate for each year was calculated and variations from this indicated years of suppression and release. The three urban sites had consistent recruitment through time. The Spring Creek site was found to have had no recruitment during the last 25 years. Higher recruitment rates and tree density were found at site two within Ballarat, which was the most frequently disturbed site. Willow age-class distributions observed in urban and rural reaches were consistent with the predicted pattern. Recurring disturbance events in urban reaches were likely to facilitate willow recruitment. This contrasted with rural reaches, especially in protected areas, which more even-aged stands with little new recruitment development. Willow management under the two recruitment scenarios should be different.

## Biodiversity and status of butterflies in the Ballarat Region, Victoria

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### Abstract

The butterfly fauna of the Ballarat region is poorly documented. Before 1995, just 11 species were contained in the Victorian Butterfly Database for the two grid squares that include Ballarat and environs. This study documents species found within 50 km of Ballarat, the status of each, their flight season and habitat use in the region. Database records are supplemented by records from transects made from 1991 to 1994, subsequent casual observations by the author, literature (including Ballarat *Courier* reports) and unpublished observations by naturalists. Ballarat (population 90,000) lies 100 km west of Melbourne, Victoria at 400-500 m altitude. Its outer suburbs include many vegetation remnants. Surrounding grasslands and grassy woodlands are small and fragmented, but larger remnants of open-forest remain. Mts. Warrenheip and Buninyong, volcanic peaks (740 m), are significant for the 17 hill-topping species, especially those with uncommon or disjunct distributions. Forty-three species (one introduced) in five families and 31 genera are now recorded. Six species are only known from historic (pre-1990) records. The best represented families in the region are Nymphalidae and Lycaenidae, with 11 species each. The forest-dwelling *Pseudalmenus chlorinda* is categorised as Endangered in Victoria. *Papilio demoleus sthenelus* and *Paralucia aurifer* are each found only at one location and are at risk. Twenty-one species forage for nectar in urban parks and gardens, including 10 species that also breed there. Early season butterflies arrive with northerly winds in late August, supplemented later by locally emerged adults. Variable numbers of migrants, mostly *Belenois java teutonia*, arrive in October and November. Butterfly abundance and diversity increase through spring and summer. In warmer months only, dense forest is used by Nymphalids (*Heteronympha*) and Pierids (*Delias*). Butterfly numbers and diversity decline as nights become cooler in April. No adult butterflies overwinter: none are seen after frosts in early May. Concomitant with the higher altitude and cooler climate, many Ballarat species have short flight seasons. Gully-dwelling adults of *Geitoneura acantha* and *Oreixenica lathoniella* emerge in warm months, substantially earlier than lowland adults.

## Research needs and research opportunities at Ned's Corner, north-west Victoria

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### Abstract

Ned's Corner Station is a property of 30,000 hectares bordering the Murray River in northwest Victoria. A former sheep and cattle station, the property is a mosaic of rare landforms and threatened ecosystems. Purchase of the property by the Trust for Nature ensures its permanent protection, and presents a unique opportunity for the long term study of restoration and sustainability in semi-arid Australia. The major vegetation consists of saltbush plains, along with Mallee woodlands, Black Box woodlands, corridors of Murray Pine woodlands on sand ridges and dunes, and corridors of River Red Gum woodlands along the Murray River. Ned's Corner epitomises many of the major environmental concerns in semi-arid Australia, including loss of biodiversity, environmental stress (especially salinity), and the effects of these two on sustainability of both natural and agricultural systems. Major research steps planned for the area include: a detailed study of the biology of the vegetation types and the major plant and animal species; a study of the techniques for, and monitoring of, revegetation; and a study of the potential for plant and animal re-introduction. Ned's Corner represents a unique semi-arid landscape in Victoria, and is strategically positioned in relation to other existing or planned conservation areas. It also represents a unique opportunity for research, and it is hoped that collaborative research projects will be forthcoming.

## Ecology of moss mats on Mount Alexander with reference to the endangered species Southern Shepherds Purse (*Ballantinia antipoda*)

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### Abstract

Southern Shepherds Purse (*Ballantinia antipoda*) is a small, cool-season annual herb belonging to the Brassicaceae family. This species is extinct in all previously recorded sites in Victoria and Tasmania and is now endemic to Mount Alexander Regional Park (749m), located 30km south-east of Bendigo, Victoria. *B. antipoda* is generally only found growing within moss mats on gently sloping granitic outcrops with an easterly aspect. The moss mats tend to grow in a thin veneer (<2 cm) of soil associated with seasonal seepage. This study was undertaken to broaden the ecological knowledge of *B. antipoda* and the associate bryophyte species. Particular reference was made to the ecological requirements of the species for future restoration and reintroduction purposes. The location and mapping of sites was conducted in relation to aspect, elevation and hydrology and compared with *B. antipoda* density. Assessments were made of *B. antipoda* phenology and longevity. There was a significant correlation between bryophyte condition and soil moisture ( $p = 0.000$ ) with regression results showing that the site with the lowest elevation, easterly aspect and greatest density of *B. antipoda*, had the most variation in bryophyte condition. Matrix plots of bryophyte species showed in the presence of *Camylopus introflexus* and *Triquetrella papillata* have a negative affect on *B. antipoda* density. A positive relationship was found between *Polytrichum juniperinum* and *Bruetelia affinis*, however, when their abundance is high *B. antipoda* densities decline. ANOVA results show no relationship between soil depth, moss depth and *B. antipoda* densities at all sites, but there is a relationship within different sites. It would appear that the presence of *Polytrichum juniperinum* and *Bruetelia affinis* in high abundance prohibits the growth of *B. antipoda*. Disturbances created by White-winged Choughs turning up moss in search of millipedes was previously believed to hinder the germination and longevity of *B. antipoda* when in fact it may reduce competition with certain bryophyte species. Further statistical analysis is currently being performed.

## Mapping willows (*Salix* spp.) using low-level, small-format aerial photography along the Yarrowee River, Ballarat, Victoria

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### Abstract

An integral aspect of weed management is the ability to describe the extent and distribution of the target species within a landscape. Weeds may be mapped in a cost effective manner using remotely sensed data that are analysed using sensing software and Geographic Information Systems (GIS). The advantage of large-scale photography is its high resolution, which facilitates the interpretation of parameters in the photographs. However, this resolution is reduced when converting to a digital format. This study aims to evaluate the use of large-scale aerial photography for mapping willows in south-western Victoria. *Salix* spp. (except *S. babylonica*, *S. x calodendron* and *S. x reichardtii*) are Weeds of National Significance. Fifty-five large-scale photographic images of a willow dominated riparian zone located in Ballarat were acquired during autumn 2003. The flight path for the photography followed the Yarrowee River and was timed to take advantage of when willows were conspicuous because of autumn “yellowing”. The area surveyed was from the Gong Gong Reservoir to Napoleons. Three basic classification techniques were used to delineate willows from rest of the image. These include manual, unsupervised and supervised classification. Preliminary results indicate that the use of imagery timed for when the willows were yellowing enhanced the manual classification technique because the willows were easily discernable from other vegetation. It was not possible to seamlessly mosaic the images, therefore each image was classified separately, greatly increasing the time required to analyse the data. Having the flight path follow the river greatly reduced the cost of the photography, however it made registration more difficult with over 35 ground control points needed per image. Data are still being analysed and the results will be presented as a poster.

## Significant vegetation maintained under a pastoral regime: the Scotia discharge complex Western New South Wales

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### Abstract

Many of Australia's inland watercourses drain internally into lakes or playas that are periodically inundated. Playas usually occur in open shallow basins, overlain by thin successions of sand, silt and clay with gypsum and embedded evaporites reflecting the ephemeral water regimes. Circular zones of decreasing salinity often exist from the playa floor to the edges and are characterised by a range of saline plant communities, which have received little attention in Australia. In western-New South Wales these communities are generally subject to high grazing pressure from stock, goats, rabbits and increased populations of macropods. A system of salt lakes occurs in the Scotia district in far western New South Wales where there has been a relatively short stock grazing history, the area having been divided into pastoral leases in the 1920s. The vegetation of the largest of these, the Scotia Discharge Complex, was assessed through analysis of data from 200 quadrats using a computer-based numerical classification procedure. For each community classified, mean species richness, total species richness and proportion of exotic species were calculated. A species list was compiled incorporating all vascular plant species recorded from quadrats and from opportunistic collection and the distribution of the communities was mapped. Ten vegetation communities were identified from the analysis from which 232 vascular plant species were recorded including 23 (10%) exotics. Five species located have not previously been recorded in the region, or have restricted distribution in western NSW. Two communities, *Halosarcia lylei* low open-shrubland, and *Hemichroa* /*Frankenia*/ *Halosarcia* low open-shrubland do not occur elsewhere in NSW. A combination of low grazing pressure and low palatability of species has contributed to the survival, in reasonably intact condition, of a suite of significant saline plant communities. These communities are not protected within conservation reserves in NSW. The purchase of Nanya Station by the University of Ballarat and the establishment of a conservation agreement will ensure the protection of these significant communities.

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