

VICTORIAN BIODIVERSITY CONFERENCE

2022
2-4 FEBRUARY
#VicBioCon22
VIRTUAL

Session 1: Science Communication & Community Engagement **Thursday 3rd February, 10.45 am – 12.00 pm**

Christina Renowden, Arthur Rylah Institute for Environmental Research

Victoria Nature Festival: celebrating meaningful ways more Victorians can connect with and act for nature

For the Victorian government to deliver the goal of its ambitious 20-year biodiversity strategy Protecting Victoria's Environment – Biodiversity 2037 we need to ensure we have 'all hands-on deck'. To this end, we work closely with the Victorian Government's environment portfolio agencies and Traditional Owner partners to protect Victoria's environment and its biodiversity and to help deliver the 'Biodiversity 2037' goal: Victorians Value Nature. Collaborating with these agencies and Traditional Owners, the Department of Environment, Land, Water and Planning co-create an annual Victoria Nature Festival. The Nature Festival is informed by and grounded in social science research from the state-wide Victorians Value Nature Survey dataset. The Nature Festival provides opportunities for broad, rich and meaningful community engagement, helping Victorians to connect with and act for nature and embrace different portals into the natural environment. The festival is themed around five pro-nature conservation behaviours providing actions which are meaningful to biodiversity conservation and are easy and accessible to the public. The growth in reach of the Nature Festival over the past two years has also created the unique opportunity to explore the festival as a behaviour change intervention. We present the findings of previous research underpinning the Nature Festival, its two-year track record of successfully engaging the Victorian community and briefly describe the exploration and potential of the Nature Festival as a catalyst for behaviour change.

Natasha Ward, RMIT University

"Totemic species" can be an effective lens for engaging students with Indigenous knowledge and biodiversity conservation

We present the outcomes of a program designed to engage primary school students with both Indigenous knowledge and biodiversity conservation, through the lens of "Totemic" species. The program provided resources for genuine engagement

with Traditional Owners, and for the coordinating teachers to dedicate time to curriculum development and delivery. The material was embedded within a cross-school core curriculum topic (biology), presenting both Indigenous and Western knowledge in parallel. Students' understanding of ecology and conservation increased significantly post-program, as did their cultural awareness and appreciation of traditional knowledge. Care for the totemic species was also shown to increase and an enthusiasm for this approach to teaching science was expressed by students. The co-benefits of this program include creating habitat for threatened species, improvements in the health and wellbeing of students through engagement with biodiversity and the potential for ecosystem services such as cooling of the school grounds. Effective ways of embedding cultural awareness and Indigenous knowledge into the Victorian Curriculum are urgently needed and it is our hope that this program could become a core component of the curriculum going forward.

Ema Corro, MYCOmmunity Applied Mycology Inc

Using DNA technology and citizen science to rapidly increase knowledge of fungal diversity

Mycology is the field that is most dependent on citizen scientists. Due to the cryptic nature of fungi, they have been very under-studied compared to flora and fauna. Only around 5% of species have even been described. Most data about their prevalence has been gathered by citizen-mycologists reporting sightings of sporing bodies. At the end of 2019 MYCOmmunity Applied Mycology initiated the Wild Fungi DNA project, which aims to rapidly increase knowledge of fungal biodiversity by developing low-cost environmental DNA techniques and training citizen-scientists in how to use them. Since then, multiple partner organisations have joined the project.

The project has three different ongoing components:

- Gathering baseline data about Australian fungi by training volunteers to collect and submit fungarium specimens along with DNA samples. The DNA samples will then have conserved regions sequenced using a MinION portable DNA sequencer.
- Developing metabarcoding methods to find all the different fungi in an environmental sample using the MinION.
- Developing simple, fast methods with little requirements for equipment to determine whether a species is present or absent from an environmental sample. The pilot study developed a LAMP test that shows presence or absence of the invasive *Favolaschia calocera* with a colour change.
- By utilizing new technology along with an engaged and passionate citizen-mycology community we believe that data about fungal biodiversity in Australia can be rapidly increased over the next few years.

Dr Holly Kirk, RMIT University (and Dr Kylie Soanes, The University of Melbourne)

Superb City Wrens

How do we ensure that delightful native species, like Superb Fairy-wrens (*Malurus cyaneus*), can persist in our cities? The Superb City Wren Project brings together local councils, ecological research and citizen science to find out.

A collaboration between the City of Melbourne, BirdLife Australia and researchers from The University of Melbourne and RMIT University, this work aims to find out where Superb Fairy-wrens are living and foraging in the city, particularly the Parkville area. This will help us implement revegetation works aimed at improving habitat for these birds and other woodland bird species across the municipality.

Using a combination of mark-recapture, citizen science and robust experimental design we will learn how this species moves around the urban landscape and what type of vegetation they rely on most in our cities. We can also investigate how engaging with this project helps residents to better connect with their local urban nature.

Dr Alex Kusmanoff, RMIT University

'Bins on Boats', a behaviourally-based intervention to curb marine pollution in Bass Strait, Australia.

I will outline the 'bins on boats' project undertaken in Victoria, Australia, which aimed to reduce marine pollution that causes entanglement amongst Australian fur seals on the Victorian coastline of Bass Strait. This program represents a successful case study in how conservation managers, industry, government, and researchers can collaborate to achieve conservation outcomes. It also demonstrates the value of taking a behavioural approach to the design of program interventions and represents an all-too-rare occurrence of program evaluation.

Dr Elodie Camprasse, Deakin University

An army of citizen scientists and their claw-some friends

Port Phillip is home to a world-renowned and spectacular great spider crab (*Leptomithrax gaimardii*) aggregation. This natural event unfolds every winter in shallow areas of the Bay including under protected piers such as Rye and Blairgowrie. Ocean lovers from far and wide come to experience the gathering of thousands of spider crabs on a mission. The crabs seek safety in numbers at the most vulnerable stage of their life: moult. After they have gotten rid of their former attire,

they need to wait for their new shell to harden, a process during which they are targeted by predators. Many mysteries surround this phenomenon so our research team at Deakin is assembling an army of citizen scientists to answer pressing questions about the spider crab aggregation behaviour and spatial ecology. There will be fun for everyone with three cohorts of citizen scientists assisting with locating aggregations, contributing to increasing our knowledge of spider crab ecology during aggregations and counting spider crabs on images obtained with timelapse cameras during aggregations. This research will be complemented by more traditional scientific surveys. Come find out more about the project!

Session 2: Fire Ecology & Conservation **Thursday 3rd February, 10.45 am – 12.00pm**

Ella Plumanns Pouton, The University of Melbourne

Using plant functional types to predict species relative abundance in fire-prone heathlands

Australian heathlands are species-rich and have a long history of fire. Consequently, heathland plants exhibit a variety of traits that help them deal with recurrent fire and other environmental conditions. These include post-fire re-sprouting, fire-stimulated germination, different modes of dispersal, and variation in time to maturity, time to senescence, and seed longevity. Species with similar combinations of traits can be grouped into Plant Functional Types (PFTs). PFTs may be useful in predicting vegetation change under different patterns of fire. Here, we used fire-related traits to group 321 species into 16 PFTs and made a priori predictions about changes in relative abundance as a function of time since the last fire and fire interval. These predictions were tested using empirical data collected at 57 sites in the heathlands of Gariwerd, in western Victoria. Preliminary results indicate correspondence between predictions and observations. For example, we predicted a bell curve response for the influence of fire interval on relative abundance for what we classified as multi-establishing obligate seeders, and this was true for relevant species *Callitris rhomboidea* and *Hakea decurrens*. Our work will identify the range of fire regimes that protect plant diversity in heathlands. Furthermore, because it focuses on the mechanisms that shape plant populations, we expect it will be applicable to many fire-prone environments.

Rachel McIntosh, La Trobe University

Identifying floristic vegetation patterns along a climatic gradient to evaluate fire management categories.

Natural patterns of vegetation are driven by numerous abiotic and biotic factors. Understanding how such factors influence vegetation can inform the use of mapped vegetation categories in land management and improve management practice. Semi-arid western Victoria is a fire-prone region, with large conservation reserves (Big Desert Wilderness Park, Little Desert National Park). Precipitation decreases and temperature increases from south to north (~100 mm less annual rainfall in the north). For fire management, vegetation is classified into broad Ecological Fire Groups (EFGs), based on aggregating finer Ecological Vegetation Classes (EVCs). We conducted floristic and vegetation structure surveys at sites stratified by location (Big Desert, Little Desert), EFG type, and time since last fire. We aimed to: 1) document floristic patterns in the vegetation associated with environmental variation (climate, soil texture), and 2) use these results to assess the relevance of management classifications. We carried out NMDS ordination and PERMANOVA analyses based on presence/absence of 227 plant species at 250 sites (>3 years since fire). Floristic composition and measures of vegetation structure varied along the climatic gradient, with marked differences between reserves in the north and south. The climatic gradient accounted for more variation in composition between sites than the relatively coarse EFG classification, which encompass diverse vegetation classes. Fine-scale EVCs were most effective in capturing underlying floristic variation and reflected north-south environmental differences. The climatic gradient appears to be a strong driver of vegetation composition and structure in this semi-arid region, likely through water availability influencing species composition via life-history traits.

Dr Johanna Martens, BirdLife Australia

Now you hear them, now you don't – post-fire assessment of Mainland Ground Parrots in East Gippsland

The 2019-20 bushfires were unprecedented in their scale and intensity, burning over 97,000km² of habitat across eastern Australia. In early 2020, the Wildlife and Threatened Species Bushfire Recovery Expert Panel developed a national priority list of fire-affected species and ecological communities requiring urgent management intervention to prevent their extinction. The Mainland Ground Parrot (*Pezoporus wallicus wallicus*) was identified as one of 17 priority avian species. Mainland Ground Parrots occur in small, fragmented populations along the eastern Australian coast, predominantly in heathland, and are listed as Endangered in Victoria. Post-fire acoustic surveys in East Gippsland, Victoria, were conducted using Autonomous Recording Units and direct listening in spring 2021. Mainland Ground Parrots were not detected in most of the heathland patches surveyed. They were detected in some

of the habitat which burnt in 2019-20, however, numbers were low. Going forward, there is a need for ongoing, standardised monitoring at the national level to inform conservation management of this species.

Amy Smith, The University of Melbourne

Playing with fire: predicting the effects of future fire management on species connectivity

Australia's forests and woodlands have been severely fragmented by agriculture, urbanisation and forestry, and in many fragmented systems, fire is used as a management tool to reduce wildfire risk and enhance biodiversity. Currently, fire managers seek to promote biodiversity by maintaining a range of fire-age classes to suit the requirements of a range of species. Crucially, this approach does not consider the effect of fire on animal movement within or among habitat patches, which is needed to maintain gene flow and genetic diversity, helping species combat environmental change and avoid extinction. Also overlooked are the implications of current fire regimes for long-term population persistence. The degree to which the landscape facilitates or impedes movement is termed functional connectivity, which influences gene flow as well as the distribution, abundance and persistence of populations. Incorporating functional connectivity into fire management will help conserve biodiversity in fragmented landscapes. In this research I use FROST (Fire Regime Operations Simulation Tool), an advanced fire regime simulation system to simulate four alternative scenarios of planned fire, with stochastic wildfire, over a 50-year period, using predicted future climate data. I will model the functional connectivity for two species over time for the alternative fire regime scenarios: heath mouse (*Pseudomys shortridgei*) and yellow-footed antechinus (*Antechinus flavipes*). The outcomes will help better understand the implications of alternative fire regimes in a changing climate.

Nathan Waddell, Deakin University

Assessing the use of artificial hollows by wildlife across fire-affected East Gippsland, Victoria

Tree hollows are a vital resource for many Australian wildlife species. The presence of hollow bearing trees is critical for the survival and reproduction of these species, and hence their preservation is vital in order to prevent further species declines and extinctions in Australia. Logging, land-clearing, urbanisation, and fire have resulted in widespread destruction of hollow-bearing trees. Their rapid loss, coupled with the long hollow formation times (often > 100 years) for most eucalypt species, means natural hollow bearing trees are now rare in many regions and the rate of recovery is

insufficient to counter their loss. This is compounded by extreme events such as the 2019-20 megafires.

Chainsaw hollows are artificial cavities mechanically carved into tree trunks or branches using power tools. The nature of chainsaw hollow construction may allow them to better replicate naturally occurring tree hollows in appearance, internal dimensions, and thermal properties. Chainsaw hollows show promise as a form of habitat supplementation, however, to date little ongoing monitoring has been performed on chainsaw hollows and factors affecting occupancy rates of wildlife species across large regions of Australia.

Our project aims to monitor occupancy rates of arboreal species within chainsaw-created artificial hollows in East Gippsland, Victoria. We aim to further our understanding of species-specific preferences in regard to artificial hollows, and how site- and landscape-scale factors, including fire, influence species occupancy and community composition. 147 artificial hollows are in the process of being surveyed, and we anticipate field work finishing in January 2021. In our presentation, we will report our findings to date. Further understanding of factors influencing artificial hollow use by wildlife will allow us to determine their efficacy for conservation actions, such as habitat supplementation.

Session 3: Terrestrial Diversity & Ecology (1) **Thursday 3rd February, 10.45 am – 11.45 am**

Carolyn Vlasveld, Monash University

Worldwide diversity and distribution of heteroblasty in plants

Some plant species exhibit heteroblasty, which entails abrupt changes in morphology during maturity. These changes can be so striking that juvenile and adult foliage of the same species can easily be mistaken for two separate species. Despite being an apparently uncommon phenomenon, heteroblasty is diverse and occurs in many different types of plants. This diversity has made it challenging to study at a broad scale, which might explain why most studies on heteroblasty focus on only a single genus or species. But observing the worldwide diversity and distribution of heteroblasty can provide important information to help explain its evolution. I searched the scientific literature to collate a list of known heteroblastic seed plant species and genera and show preliminary distributions of these heteroblastic taxa across a) seed plant orders and b) life form categories. Heteroblasty appears widespread across the seed phylogeny with heteroblastic taxa found in 37 of 69 seed plant orders. However, some orders seemed more likely to exhibit heteroblasty than others, especially those mostly comprised of trees and other woody taxa. Heteroblasty occurs among diverse life forms, but it appears especially frequent in trees. These results suggest that heteroblasty might be most commonly used for dealing with environmental heterogeneity that is experienced

by trees due to great differences in stature between younger and older plants (e.g., juvenile adult differences in light- availability or herbivore vulnerability).

Jessica Chapman, La Trobe University

Factors Affecting the Capacity of Ground Foraging Insectivorous Birds to Regulate Insects in Grazing Land

To mitigate the negative impacts of agricultural intensification on wildlife, it is crucial to find ways to incentivise farmers to make their land more wildlife friendly. One way to support this is to demonstrate and quantify the roles that wildlife play in delivering ecosystem services. As a form of conservation biocontrol, birds may suppress invertebrate pests, reducing damage to pastures and crops, if enough native habitat exists in the landscape to support avian populations. In this study, I used targeted bird surveys in remnants and adjacent grazing paddocks to assess the impact of remnant habitat type, presence/absence of scattered trees, and other factors such as grazing intensity and livestock present on the density, diversity, and foraging rates of birds in agricultural areas. My results suggest that the same species use paddocks regardless of remnant habitat type, scattered trees in paddocks have a significant positive effect on the density, diversity, and foraging rates of birds and that they are more likely to travel further into a paddock from a remnant if scattered trees are present. I used my results to create an equation that combines a standard method of calculating field metabolic rate for insectivorous birds with density estimates from my data to calculate how many kilojoules or grams of fresh matter we expect the bird community to remove from a grazing pasture per day based on distance from the nearest remnant and presence/absence of scattered trees.

Jessica Presnell, La Trobe University

Genomics to understand hybridisation and genotype-phenotype associations in an endangered bird threatened by genetic introgression

Understanding the consequences of hybridisation between populations can lead to improved conservation outcomes. The black-eared miner (*Manorina melanotis*) is an endangered honeyeater which has experienced increasing contact with its congener the yellow-throated miner (*M. flavigula*) as a result of fragmentation and modification of Mallee habitat in the 1940-50s. Increased contact has led to high rates of hybridisation between the two species and increased prevalence of hybrid phenotypes. Introgression and genetic swamping as a result of hybridisation is considered one of the greatest threats to the black-eared miner. However, current assessments of hybridisation levels are based on morphology which might not reflect the genetic ancestry of individuals.

Utilising highly-resolving genome-wide SNP data and morphological data, our study provides the first molecular assessment of the genetic distinctiveness of the black-eared miner and extent of hybridisation in the population. We also explored correlations between phenotype and genetic ancestry, and genetic diversity. We found the black-eared miner was genetically differentiated from the yellow-throated miner, and possessed unique genetic diversity. There was evidence of extensive hybridisation, but the persistence of 'purer' black-eared miner genotypes and phenotypes indicated that complete genome swamping had not occurred. Although phenotype was correlated with genetic ancestry, phenotypic traits used to classify the birds did not consistently match their genetic ancestry. Black-eared miners were consistently more inbred and possessed lower genetic diversity than both hybrids and yellow-throated miners. Whilst introgression is considered a threat, allowing hybridisation (to an extent) might lead to improved genetic diversity and evolutionary potential of black-eared miners.

Suzanne Moss, La Trobe University

A multi-decadal study of vegetation dynamics in grasslands on the Bogong High Plains

It is widely accepted that alpine grasslands are vulnerable under current climate change predictions. Warming temperatures allow for the invasion of woody species into these areas. However, land-use history is another important factor to consider in understanding grassland dynamics. A prolonged history of grazing exists in the Australian Alps. Domestic stock are responsible for altering the species composition of grasslands and increasing the availability of bare-ground. With their removal in the late 1990's and early 2000's we aimed to gauge how these grasslands have maintained their structure and recovered palatable species.

In 1982 40 grassland sites were surveyed while undergoing cattle grazing. We resurveyed these sites in the Summer of 2021, 20 to 30 years after the cessation of grazing. During this period, this area has also experienced fire, drought and a warming climate. We found that these grasslands have undergone significant structural changes with a third transitioning into shrub-dominated communities. Across the two surveys species composition changed significantly. Species richness declined as did average cover of graminoids. Herbs have had a mixed response, with some palatable species increasing and other disturbance-favouring species declining. The influence of disturbance history and climatic changes are difficult to differentiate and are both likely responsible for these changes. These results suggest that many of these alpine grasslands are still experiencing lasting effects following decades of disturbance under grazing.

Tamandra D'Ombra, La Trobe University

Chromosomal assessment and population genomics to inform conservation of the endangered Matted Flax-lily (*Dianella amoena*)

The impacts of anthropogenic landscape modification such as habitat loss, degradation and fragmentation threaten many species worldwide. Effective management of such species requires thorough research, including genetic considerations to maintain adaptive potential in changing environments. The Matted Flax-lily (*Dianella amoena*) is an endangered, frequently translocated inhabitant of fragmented grassy ecosystems of south-eastern Australia. Polyploidy is prevalent in the genus, but there are no chromosome counts or ploidy assessments for *D. amoena*. This research aimed to ascertain the ploidy of *D. amoena* and to assess the population genomic structure of remnant patches to inform conservation management, with a focus on Victorian populations.

Chromosome staining revealed polyploidy (likely $2n=6x=48$ chromosomes), along with intraspecific ploidy variation in a limited number of specimens. Single nucleotide polymorphisms (SNPs) were sequenced for individuals spread across 34 localities (with extensive sampling of two sites to examine clonality), allowing comparison of 3,116 SNPs between 322 unique genotypes. Some localities had low heterozygosity which was consistent with samples of confirmed lower ploidy, further supporting multiple cytotypes. Population differentiation analyses (PCA, STRUCTURE) suggested minimal divergence, including between samples separated by up to 800 km, however, limitations of polyploidy may mask differentiation. Fine-scale clonality assessment revealed that intermingling of genets in visually continuous patches is common. Overall, management recommendations are that translocations across moderate distances are unlikely to disrupt natural composition, but they should avoid mixing of cytotypes. Further, population estimates based solely on observations are likely inaccurate, and salvage translocations should incorporate genomic research to ensure genotypic diversity is captured.

Virtual Poster Session

Thursday 3rd February, 12.00 pm – 12.30 pm

#1 Iris Hickman, La Trobe University

Alpine shrub functional traits varies with altitude: what are the implications under climate change?

The distribution and survival of alpine vegetation are influenced by snowfall directly (thermal protection) and indirectly (growing season length). Plants living in alpine regions depend on snow for protection against high diurnal and microclimate variability in winter and early spring. However, with snow projected to significantly

decrease with climate change, alpine species may adapt to changing conditions through phenotypic plasticity or genetic changes, i.e., morphological adaptations.

The natural variation of traits across environmental gradients can inform the adaptive potential of alpine species. This study investigates how elevation, and the associated changes in abiotic variables, influence plant traits (morphology) of alpine shrub, *Grevillea australis*, in the Australian alpine region.

Our results showed intraspecific trait variation associated with changes in elevation. For example, shrubs at lower elevations were taller and had thicker leaves, while at high elevations shrubs were shorter and had thinner leaves. These findings show a shift in ecological strategy in response to changing abiotic stressors. The trends observed demonstrate the potential role of phenotypic plasticity in response to environmental change. Trait plasticity is crucial for future climate change scenarios and may allow species to persist in the currently rapidly changing environment.

#2 Lauren Tworkowski, La Trobe University

Impacts of terrestrial heat waves on survival of moulting adult little penguins

Continued warming of the Earth's atmosphere is having a range of ecological, behavioural and physiological impacts on seabirds. The effects of changes in sea surface temperatures on seabirds are well-documented, but the effects of high ambient temperatures on land are not. Like all penguins, moult in Little Penguins is 'catastrophic', with all feathers shed and replaced in ~18 days. As they do not have adequate insulation and waterproofing to forage at sea, they are constrained to land in some of the hottest parts of the year. Long-term survival analysis suggests that adult mortality is greatest in years when high ambient temperatures are paired with low humidity during moult. Given current climate projections, successful management of Little Penguins requires a better understanding of the physiological processes and habitat features that influence mortality events.

In this study we aimed to identify which birds are most at risk of heat stress during moult, and why. Using a novel approach to field respirometry, we investigated thermoregulatory costs of moulting birds in response to ambient temperature and humidity. Our results predicted that penguins in early stages of moult would be most affected by heat exposure, as they displayed a significant increase in metabolic rate at higher temperatures compared to mid and late moult birds. During a heat wave in 2019, the largest adult Little Penguin mortality event on record occurred during moult at Phillip Island in south-eastern Australia. As predicted, all recorded deaths were birds in early stages of moult. We are currently quantifying the microclimates of burrows and vegetation types and investigating how birds are using structural habitat during extreme weather events. Results will help determine how birds are currently coping with extreme temperatures on land, and identify

adaptation options most likely to reduce negative climate change impacts for the species across their distribution.

#3 Ben Smith & Andrea Canzano, Darebin City Council

Rewilding Darebin: Enhancing Biodiversity and Supporting our Community During a Global Pandemic

In 2016, The City of Darebin became the first council anywhere in the world to declare a Climate Emergency. In response, Darebin's Open Space Strategy was adopted in 2019 with a key focus on enhancing biodiversity, recreating resilient landscapes for community well-being and expanding habitat for local fauna species by making indigenous bushland character the default choice in open space planning.

With Stage 3 COVID-19 restrictions in force, Darebin's Parks and Open Space Team initiated the Rewilding Darebin program with the aim of revitalising open space throughout Darebin and providing gainful employment to internal staff from across the organisation who were impacted by the pandemic.

The program was established by key staff in April 2020. Indigenous plants of local provenance were sourced where possible through numerous businesses across Melbourne. A multi-criteria analysis was established to prioritise sites with parameters including 'connectivity', 'areas of socio-economic disadvantage' & 'habitat potential' while factoring in future maintenance considerations.

Rewilding activities have occurred in conservation zones, creek corridors, sports oval surrounds, new capital works projects and existing parks across the municipality. This has resulted in 300,000 plants planted in the ground, creation of 13 hectares of new plantings, and an increase of biodiversity across approximately 10 hectares of infill planting across a total of 50 different sites.

The Rewilding initiative at Darebin has become the flagship environmental program and now features heavily in the new four-year Council Plan, continuing the commitment of transitioning towards a biodiverse rich open space system. With Rewilding complimenting several key council projects across multiple departments within Darebin, a commitment has been made to continue to resource and expand the program moving forward, including the establishment of a volunteer program for the Darebin community.

#4 Nina Roberts, La Trobe University

Bringing the yams back: collaboration with a First Nations Women's Knowledge Group in Central Victoria

The Yam Paddock Project centres a group of Dja Dja Wurrung Women in a knowledge-building collaboration between university researchers and Tradition Owners in Central Victoria. The newly-formed Women's Knowledge Holders Group (WKHG) brings women's embodied presence and cultural practices back onto their Country, sometimes for the first time since colonisation. Dja Dja Wurrung Country has been vastly altered in the intervening 190 years, by agriculture, gold mining and urbanisation. The WKHG hope to bring culturally important plants such as Murnong (*Microseris walterii*) back to selected sites on Country, or encourage their flourishing where they persist in remnant vegetation. Cultural fire and the use of traditional women's digging sticks are core practices for Caring for Country and reviving culture. The ecological PhD study that is partnered with the endeavours of the WKHG offers an opportunity for building knowledge of the plants. It aims to facilitate the WKHG using and directing Western Science as a tool to meet their objectives without the knowledge system overshadowing their cultural ways of knowing. This poster outlines a research approach appropriate to this context, including acknowledgement of past and present power-dynamics between knowledge systems. Cultural awareness and committing to relationship-building have been foundational to development of this approach. The role of ecological research methods in the knowledge revival process is more acceptable to the WKHG when framed as examining ways to mitigate impacts of colonisation (such as weeds and introduced fauna). The collaboration is not about testing the efficacy of cultural practice on Country.

#5 Abigail Parker, Monash University

Research in progress: PFAS exposure in Victorian freshwater turtles and its impact on their reproductive success.

Per-and polyfluoroalkyl substances (PFAS) enter the aquatic environment directly from treated wastewater effluent, run-off in urban stormwater, and leaching from contaminated soil and groundwater into freshwater systems. PFAS are highly resistant to biodegradation which has raised concerns over human health and the environment. However, there is a lack of ecotoxicology studies on reptiles. Turtles are ideal bioindicators for monitoring the level of PFAS in the aquatic environment because they occupy a high trophic position in the food chain, are long-lived vertebrates and are highly mobile. Therefore, turtles are likely exposed to an array of contaminants during the course of their lifespan. Particularly in Melbourne, freshwater turtles are highly prolific and occupy a range of sites of varying expected contaminant exposure. I am investigating the presence of PFAS in freshwater turtles by collecting blood samples from Eastern long-necked turtles (*C. longicollis*) and

Murray River turtles (*E. macquarii*) in Metropolitan Melbourne. Furthermore, I am investigating potential maternal transfer of these contaminants by collecting egg samples and potentially hatchling blood samples. Lastly, I will investigate the pathways by which PFAS are accumulated by turtles by collecting environmental samples (water, sediment) and samples of turtle diet items (invertebrates, fish, algae). My findings will also provide an overall assessment of ecosystem health and thus be relevant to other aquatic species. The research will address a potentially acute problem of environmental pollution, through understanding the current levels of PFAS and their effects in wild turtle populations.

#6 Cassie Speakman, Deakin University

Fear vs. Food: Exploring behavioural and population-level responses to environmental change and predation pressure in Australian fur seals

Understanding how wild animals respond behaviourally to changes in their environment can be a crucial factor in predicting how vulnerable a population is to change. It can be challenging, however, to understand when behavioural changes are biologically meaningful at the population level, particularly for long-lived or cryptic species. State-dependent life-history theory models implemented via stochastic dynamic programming (SDP) have been used to explore these linkages by identifying the optimal choices of an individual in the context of its own physiology and the state of the environment, allowing us to explore how conditions outside of the norm impact behaviour. Here, we developed an SDP model using Australian fur seals as a case study to investigate the individual and combined effects of changes in predation risk and prey availability on reproductive and behavioural decisions and ultimately population dynamics on this long-lived predator. We show how predation risk influences when individuals return to land and how this varies with individual condition. While prey availability also influenced behavioural decisions, it had a greater influence on the reproductive success of females. With climate change driving shifts in the distribution and abundance of marine species at all trophic levels, it's important to understand how such shifts may impact endemic species such as the Australian fur seal.

#7 Jo Stubbs, The University of Melbourne

How does the environmental volunteer group Friends of the Prom conduct ecological restoration of Yiruk/Wamoon, under the permits, regulations and permissions of Parks Victoria?

Established in 1979 and located at Yiruk / Wamoon (Wilson's Promontory National Park) on Gunaikurnai, Bunurong and Boon Wurrung Country, Friends of the Prom is a

volunteer run, not for profit which conduct ecological restoration works under the permits, regulations and permissions of Parks Victoria.

They engage the public through the Parks Victoria platform to organise volunteer days, such as weed removal of Sea Spurge (*Euphorbia paralias*) from Prom beaches to restore habitat for Hooded Plover (*Thinornis rubricollis*), beach rubbish removal and documentation, scat counting on the Yanakie Isthmus and population counts of Orange Bellied Parrot (*Neophema chrysogaster*), Hooded Plover (*Thinornis rubricollis*) and other shorebirds.

At the Tidal River Nursery, they conduct seed and cuttings collection of prom indigenous plants to ensure local seed provenance and genetic integrity, which are then stored or propagated for ecological restoration projects, such as planting and guarding of Swamp Gum (*Eucalyptus ovata*) to restore Strzelecki/South Gippsland koalas' habitat.

They collaborate with organisations to conduct science research projects, such as the Victorian National Parks Association on Grass- tree dieback caused by water-borne pathogen Cinnamon Fungus (*Phytophthora cinnamomi*), and Strzelecki Koala Action Team to create the "Strzelecki Koala Map" of Strzelecki/South Gippsland koala activity.

#8 Kevin Newman, The University of Melbourne

An Analytical Solution for Optimising Multi-Species Detection Surveys

When undertaking surveillance for multiple species the probability of detecting each species at a site for a given level of survey effort is rarely 1. As such, there is a trade-off between the number of sites to survey, and the survey effort per site. Conservation budgets are limited, and inherent costs of surveying need to be considered to ensure that survey design is optimal to meet required objectives. These costs can be simplified into two categories, site establishment costs and the cost of visiting, surveying or processing a site after establishment.

#9 Sophie Moore, Macquarie University

Street tree chat

The diversity of street trees within urban forests is influenced by the aesthetics, needs and convenience of residents. The species that humans introduce to cities contribute to species richness, though their presence may mask the effects of extinction of native species. The selection of tree species for street planting can favour certain taxa with particular functional traits and/or homogenise plant traits

within and between urban areas. Street trees can include locally endemic species amongst introduced species. Higher trait diversity and functional complementarity can increase ecological and climate resilience of the urban forest, but the extent to which this might occur across urban areas remains unexplored. Here, we use taxonomic and key plant functional trait data (leaf area, seed mass and maximum height) to compare the species richness and functional diversity of planted street trees to those of native trees endemic to Australia's two largest cities, Sydney and Melbourne. We show that while there are four times more planted street tree species relative to native trees within these two cities, native and planted species occupy a similar volume of trait space, leading to functional similarity in the functional diversity of these tree groups. However, nearly two thirds of planted species add little to the overall functional diversity of street trees, implying low functional complementarity (i.e., high redundancy) among planted species resulting from a cluster of similar traits that is absent from the native tree species examined. As 30% of native tree species are not currently used as street trees, we make recommendations about their ecological suitability by ranking their capacity to tolerate broader environmental conditions.

Session 4: Urban Ecology & Conservation **Thursday 3rd February, 2.30 pm – 4.05 pm**

Dr Kylie Soanes, The University of Melbourne

Conserving biodiversity in Australia's cities – what, where and how?

The importance of urban biodiversity is well-recognised. City councils and land managers are at the frontline of urban conservation, driving changes on the ground to enhance cities for nature and people. Yet there has been little guidance on which actions to take or how to negotiate the complex social-ecological-political space of urban environments. We interviewed urban environmental managers from state and local government and not-for-profit organisations in five Australian capital cities to 1) capture the breadth of actions undertaken to conserve biodiversity in urban environments and 2) understand what enables or inhibits conservation success. We present a nation-wide inventory of actions for urban biodiversity conservation, common barriers faced by urban environmental managers, and the pathways they use to achieve conservation outcomes.

Jacinta Humphrey, Research Centre for Future Landscapes, La Trobe University

Avoid, adapt or exploit: Modelling avian species responses to housing and canopy tree cover

Avian responses to urbanisation are often complex and species-specific. Whilst many bird species are negatively affected by increased human infrastructure or reduced native vegetation; others may benefit from these changes. To better understand the spread of responses, researchers have classified birds into groups based on urban tolerance, including urban avoiders, adapters, and exploiters. The current understanding of these groups, however, is based primarily on human infrastructure and may overlook measures of natural habitat. An improved understanding of how individual species respond to both human infrastructure and habitat may help to better predict shifts in community composition and identify groups threatened by urban development. We used a landscape-scale approach to investigate how individual bird species respond to urbanisation in Melbourne. We selected 30 study landscapes (each 100 ha), stratified to represent gradients of cover of housing (from 9 – 39%) and canopy trees (13 – 63%), and conducted 1,500 timed bird surveys (50 per landscape) over 16 months. The occurrence of species classified as avoiders, adapters and exploiters differed significantly across the study region. However, current classifications explain only 18% of the variation observed among landscapes. Half of all avoiders and adapters declined with increasing housing cover, and increased with canopy tree cover. In contrast, up to 40% of urban exploiters showed the opposite trends. These findings suggest that if development continues in greater Melbourne, there will be further declines in urban avoiders and adapters, and an increase in urban exploiters, resulting in a measurable shift in avian community composition.

Alicia Dimovski, La Trobe University

Does urban lighting affect the health of Australian mammals?

Artificial light at night (ALAN) is one of the most common and fastest growing forms of urban pollution and has been identified as a key threat to biodiversity. ALAN fundamentally changes the night-time environment by masking natural light cues and desynchronising the body's internal clock. Energy-efficient lighting, such as white LEDs may have an even greater impact on wildlife. This is because they consist primarily of short blue wavelengths which play a greater role in regulating circadian rhythms. Therefore, while there are obvious environmental benefits, there may be serious consequences for wildlife. However, one advantage of LED light is the flexibility to change the colour and wavelengths. We investigated the effect of white LEDs (standard urban lighting) and amber LEDs (proposed wildlife friendly) on glucocorticoid expression in the Krefft's glider (*Petaurus notatus*). Amber LEDs were designed to exclude short wavelengths, and therefore are predicted to have little effect on circadian rhythms. Wild-caught *P.notatus* were allocated to one of three

treatments: 1) control (no lighting), 2) white LED lighting, or 3) amber LED lighting. Faecal glucocorticoid metabolites (FGM) were monitored at regular intervals throughout the experiment to examine changes in hormone expression over 4-weeks exposure to dim light at night. Our results indicate that exposure to white LEDs increases FGM concentrations, while exposure to amber LEDs decreases in FGM concentrations. Findings from this study will improve our understanding of physiological impacts of artificial light at night on wildlife and support the development of "wildlife-friendly" lighting in urban areas.

Katherine Berthon, RMIT University

Plant Insect Dating in the City: Using pollinator preferences to inform our greenspace designs

The ability of insects to persist in urban greenspace depends on their ability to usefully interact with available plant resources. Greenspace design may influence plant-insect interactions by: 1) limiting the plant-species pool available for interaction through plant choice, 2) limiting the persistence of insects, making them unavailable for interaction; and 3) mediating insect preferences based on the design context through structural barriers, microclimatic changes or competition. My PhD research uses information on how pollinators interact with urban plant resources, and how these interactions change in different contexts, to inform design guidelines to maximise biodiversity. We have monitored 12 garden bed sites in Melbourne CBD for 12 months to assess the plants being utilised by pollinators, whether these are the same among pollinator groups (hoverflies, native bees, honeybees, and others), and how these change given variation in flower availability across seasons. We use our results to make recommendations about plant palettes that could be used to support a diversity of pollinators throughout the year.

Rachael Miller, The University of Melbourne

Quantifying Biodiversity on the University of Melbourne's Campuses

This talk will showcase the work undertaken in the biodiversity space at the University of Melbourne since November 2019. Many student interns and casuals have contributed to the Biodiversity Baseline Data Project which aims to quantify biodiversity baselines for all University campuses to halt the decline of biodiversity on campus. As the University looks to finalise these baselines and set its strategic direction for Biodiversity Management moving forward in the upcoming University Sustainability Plan 2030, we wish to share the lessons learned, plans for the future and receive feedback and input from those in this sector/ area of study. The talk will feature case studies and examples of our achievements and showcase the positive and negative findings from the Biodiversity Baseline Data Project.

Sophie Moore, Macquarie University

Street tree communities have high taxonomic richness but noticeable functional redundancy relative to native trees

The diversity of street trees within urban forests is influenced by the aesthetics, needs and convenience of residents. The species that humans introduce to cities contribute to species richness, though their presence may mask the effects of extinction of native species. The selection of tree species for street planting can favour certain taxa with particular functional traits and/or homogenise plant traits within and between urban areas. Street trees can include locally endemic species amongst introduced species. Higher trait diversity and functional complementarity can increase ecological and climate resilience of the urban forest, but the extent to which this might occur across urban areas remains unexplored. Here, we use taxonomic and key plant functional trait data (leaf area, seed mass and maximum height) to compare the species richness and functional diversity of planted street trees to those of native trees endemic to Australia's two largest cities, Sydney and Melbourne. We show that while there are four times more planted street tree species relative to native trees within these two cities, native and planted species occupy a similar volume of trait space, leading to functional similarity in the functional diversity of these tree groups. However, nearly two thirds of planted species add little to the overall functional diversity of street trees, implying low functional complementarity (i.e., high redundancy) among planted species resulting from a cluster of similar traits that is absent from the native tree species examined. As 30% of native tree species are not currently used as street trees, we make recommendations about their ecological suitability by ranking their capacity to tolerate broader environmental conditions.

Dr Scarlett Howard, Deakin University

Elemental learning in native Australian bees across urban gradients

Urbanisation has been implicated as a major driver of insect decline. Urbanisation results in an increase in impervious surfaces, temperature increase, loss of habitat, pollution, greater non-native flora and fauna, and an increase in pesticide and herbicide use. The general consequences of urbanisation on bees include lower flower visitation rates, low species richness, loss of rare species, and homogenisation of species pools. The impacts of urbanisation on important behaviours, such as cognition and learning, are relatively unknown. In ongoing work, I am examining the learning abilities of native Australian bee species across urban gradients (high density urban sites, suburban sites, relatively undisturbed State Park sites). Urbanisation may result in cognitive impairments in native bees due to higher stress, exposure to pesticides, or limited access to appropriate nutrition. Conversely, urban areas may select for superior learning abilities due to the need for cognitive flexibility and learning in these complex environments. This work will allow us to determine how

urbanisation is impacting native bee behaviour and hopefully disentangle what environmental aspects may cause cognitive impairment. Understanding how a variety of bee species respond to environmental change is vital when developing future strategies to support native bees in urban environments and when creating urban greenspaces which benefit both pollinators and humans.

Thami Croeser, RMIT University

Depaving paradise: converting redundant urban car parking to green space

In this presentation, I show that there is a large amount of redundancy in Melbourne's inner-city parking. Thousands of parking spaces show potential for conversion to new green areas. I present a basic design that could be applied to reclaimed street parking spaces, and describe the results of my collaboration with specialists in urban forestry, urban ecology and stormwater management to model the benefits. In short: there's a lot of parking we could reclaim, and if we pull that off, we get hectares of tree canopy, significant improvements in ecological connectivity, and can treat quite a few million litres of stormwater each year.

Session 5: Environmental Policy & Management **Thursday 3rd February, 2.30 pm – 4.05 pm**

Dr Danny Spring, The University of Melbourne

Conflicts of interest in conservation

Many conservation activities are delegated by governments, conservation organisations or private philanthropists to other people, including private landowners who are paid to retain wildlife habitat, and polluting businesses and households who are paid not to pollute. Conflicts of interest arise in these relationships when the delegated party's personal or business interests conflict with the requirements of a successful conservation program. This presentation will identify recent Victorian examples where conflicts of interest, combined with a lack of information on the suitability of private parties for carrying out conservation activities, has resulted in failed environmental protection programs. Case studies are discussed including failed biodiversity offsets programs for protecting biodiversity within Melbourne's urban growth boundary, a waterway protection program, and programs aimed at reducing net greenhouse emissions. Simple program design principles are proposed that would have addressed conflicts of interest in the selected case studies. The presentation concludes with a discussion of the likely prevalence of conflicts of interest in conservation programs and its broader impact on biodiversity and pollution outcomes.

Loulou Gebbie, EcoGipps

The Biodiversity Opportunity

Natural Capital accounting is transforming the way we measure and value our natural assets and making a big contribution to maintaining and protecting them. Biodiversity is humanity's most vital asset. It is also our most critical investment opportunity. Currently biodiversity is in rapid decline. Australia has the highest extinction rate of all developed nations, and the second highest globally. Not only is this happening at an unprecedented rate, but it is also happening in ways that are not easy to see or locate and with feedback loops that are unforeseen or not yet understood. Historically, our economic systems have been ill-equipped in accounting for the natural world. However, when we realise that our economies are bound by nature and that natural capital is an integral asset to include on our balance sheets, we are presented with an opportunity to create mechanisms for investment in nature. Put simply, it is a matter of supply and demand. In order to remedy this imbalance current trajectories will not help us; they will only make things drastically worse. There is a lot we can learn from the infrastructure driving the climate transition. Likewise, there is a lot we can learn from each other. Creating collaborative networks that include diverse knowledges and voices will have the best outcomes for people and the environment as we navigate the nature-positive transition.

Ielyzaveta Ivanova, Monash University

The potential of small protected areas with poor habitat to form viable clusters for long-term protection of species

This study analyses 31 Australian native mammal species for which most of the Australian protected area network was identified by Ivanova & Cook (in press) as not sustaining viable populations, with a particularly small contribution observed from privately protected areas (PPAs). We aim to understand what causes the network to underperform for these species in particular, and how the spatial arrangement of habitat within PAs can be most effectively utilised to ensure that more areas are able to support viable populations through connectivity. We determined the percent of PA area covered by habitat for each species and how this differs between public and private PAs, and whether the size of the PA and the habitat quality within are related to its chances of independently supporting a viable population. To place the PAs in their landscape context, we examined the proportion of viable versus non-viable PAs surrounded entirely by habitat, and how far habitat-containing PAs tend to be from each other. This was compared with estimates of species' dispersal distance as a measure of connectivity. Viable PAs tended to be more than 100 times larger than non-viable ones and contained habitat of more than a third higher quality – both statistically significant differences. Considering both viable and non-viable PAs, most distances to the nearest

neighbour PA fell within the calculated dispersal capability of the species, with 27/31 species having more than half of their habitat-containing PAs within a distance of their neighbour that is within that possible for regular movement of species.

Arman Pili, Monash University

Advancing Invasion Science *in silico*: Simulating the Population Dynamics and Management of a Globally Significant Invader, the Cane Toad (*Rhinella marina*)

The escalating impacts of invasive alien species (IAS) on ecosystems and human societies warrant biosecurity decision support tools. One of the most globally significant and well-studied IAS is the cane toad (*Rhinella marina*). Despite the many pragmatic models developed to guide in halting cane toad invasions, none reliably predict its population dynamics, much so management outcomes, at spatiotemporal scales and resolutions relevant to management. We showcase here a novel spatially-explicit, temporally-dynamic, mechanistic, individual-based model of the cane toad —virToad — for predicting and understanding the species' local- to landscape-scale spatiotemporal population dynamics, and for exploring, optimizing, and recommending cost-effective landscape management responses.

virToad's design is premised on the effects of social interactions (kin selection) and environmental constraints (desiccation risk) on life-history, collectively driving the emergence of population dynamics. To demonstrate virToad's utility for its intended purposes, we conducted *in silico* experiments where we simulated the cane toad's population dynamics without management, and under alternative management scenarios. Here, we simulated five management strategies: toad-busting, light- and advertisement call-baited [LAB] trapping, fencing water bodies, tadpole trapping, and chemical suppression. We showed here how virToad produces realistic and compelling predictions that shed new light on the cane toad's population density, distribution, and age-sex structure. *In silico* experiments show that management strategies variably impact cane toad population dynamics, but that only moderate- to high-intensity toad busting and LAB trapping had significant lasting effects. virToad is an indispensable decision-support tool enabling researchers and practitioners to predict, understand, and respond more efficiently to cane toad invasions.

Ayesha Burdett, River Bend Ecology

Tracking changes in the macroinvertebrate community at Walker Swamp Restoration Reserve

The Walker Swamp Restoration Reserve in southwest Victoria sits in the floodplain of the Wannon River. After a long history of agricultural land use, and more recently

plantation forestry, Walker Swamp was recently purchased to become a wetland reserve that is now being actively managed by Nature Glenelg Trust to restore and reconnect over 440 hectares of wetlands.

Understanding the abundance and composition of the macroinvertebrate community was identified as one way to examine waterbody health and observe changes over time due to the restoration work on site.

Freshwater macroinvertebrate surveys were conducted in December 2018 and 2020 across the Reserve. Nearly 150 taxa have been identified from the surveys. Notably, 33 taxa that were collected in 2018 were not collected in 2020, while 19 taxa identified in 2020 were new observations for Walker Swamp (not collected in the 2018 survey). The invertebrate community was characterised by a suite of cosmopolitan and robust taxa, particularly microcrustaceans and mobile, early-colonizing hemipterans and dipterans.

Total macroinvertebrate abundance was significantly greater in 2020 than in 2018, but there was variability among survey sites. Taxonomic richness and diversity measures was similar among sample years (2018 and 2020) within the established portion of the wetland but significantly lower in the recently inundated areas.

These surveys demonstrate that local microhabitats and broader hydrologic patterns influence the invertebrate community over time.

Dr Zoe Squires, Arthur Rylah Institute for Environmental Research

A systems approach to promoting domestic cat containment

As part of the Victorians Valuing Nature Goal of the Biodiversity Strategy 2037, we are committed to promoting responsible pet ownership behaviours including 24-hour domestic cat containment. LGA's across Victoria have varying levels of containment policies with 13% of LGAs mandating 24-hour containment, 29% mandating 12-hour containment and 58% having no containment policies. Public engagement and education around 'how to' effectively contain cats is a key component for promoting more containment and to support more LGAs to mandate containment. We collaborated with Zoos Victoria and RSPCA Safe Cat Safe Wildlife Campaign, Animal Welfare Victoria and some LGA representatives to deliver a Cat Containment Knowledge Exchange event, sharing best practise and resources to improve the uptake of cat containment in Victoria. We also surveyed Victorians about their attitudes towards cat containment and found that cat containers were more motivated by improving their cat's safety than by outcomes for wildlife. These findings will help to design effective messaging to promote containment.

Session 6: Threatened Species
Thursday 3rd February, 2.30 pm – 4.05 pm

Robin Sinclair, Deakin University

Using scat-detection dogs to describe the diet of red foxes (*Vulpes vulpes*) in the Grampians (Gariwerd) National Park

As an introduced predator in Australia, red foxes (*Vulpes vulpes*) have contributed to the decline and extinction of many native species and are considered an agricultural pest. Studies of the diet of introduced predators can provide information to support effective management of these species and their prey. We used conservation dogs to conduct the first systematic study of the diet of foxes in the Grampians (Gariwerd) National Park, a reserve with important biodiversity and cultural values where foxes have been controlled via regular poison baiting since 1996. The diet of foxes in the park is dominated by native mammals, particularly the locally abundant swamp wallaby (*Wallabia bicolor*). Four threatened species were detected in fox scats including the long-nosed potoroo (*Potorous tridactylus*) and southern brown bandicoot (*Isodon odesulus*) which had previously been undetected in the park for several years. The detection of brush-tailed rock wallaby (*Petrogale penicillata*) remains in fox scats far from the known location of the park's reintroduced population may be evidence of previously unknown populations of this vulnerable species. Scat-detection dogs proved to be a highly efficient method for collecting many fox scats in a short period where systematic surveys and opportunistic collection failed. We suggest using conservation dogs in this way may be an effective method for collecting large numbers of scat samples to describe the diet of predators and for detecting rare and cryptic prey species.

Flossy Sperring, Monash University

Better home-ranges and gardens; using home range analyses to investigate how habitat restoration can improve territory quality for a Critically Endangered island owl

By 1986, the population of Norfolk Island moreporks had declined to just one female. This was most likely as a result of many contributing factors including habitat loss, secondary poisoning and low genetic diversity. Two male New Zealand moreporks were subsequently introduced onto Norfolk Island, one of these disappeared and the other successfully bred with the female. 35 years later, the population consists of only 20-35 individuals, and monitoring demonstrates a decrease in breeding success. To assist the population, management interventions may be necessary to restore habitat and increase the carrying capacity of the island. This study aims to investigate how habitat type influences the territory size of Norfolk Island moreporks, and help inform vegetation management on the island. Between 2019 – 2021, ten owls were radio-tracked with six repeat captures over multiple seasons. GPS fixes

were recorded at 30-minute intervals each night for 14 – 28 days for each owl. We used high-resolution spatial data to generate patch size, canopy height, elevation, slope, canopy cover and vegetation class data. Owls holding territories outside of the National Park occupy larger territory sizes, and patch size is an important habitat characteristic. While owls prefer native vegetation to woody weeds, vegetation type was not a strong predictor for habitat suitability. Here we use territory mapping as well as vegetation structure, topography and land-use type to investigate which restoration strategy might optimise the number of territories available for moreporks in the Norfolk Island group.

Nick Bradsworth, Zoos Victoria

Risk-spreading required: attempts to establish a new population of Helmeted Honeyeater

Range-restricted species are among those at the greatest risk of extinction due to climate change. For more than a decade, the population of critically endangered Helmeted Honeyeater has been confined to a single locality, Yellingbo Nature Conservation Reserve, 50 km south-east of Melbourne. The establishment of new populations to provide risk-spreading is an urgent priority for the Recovery Team, however options are limited owing to the widespread destruction of the taxon's preferred habitat. In August 2021, 32 Helmeted Honeyeaters, comprising 14 captive-bred and 18 wild-sourced birds, were released at a new location in Yarra Ranges National Park, 30 km from the last wild population at Yellingbo. Birds were held for 1-3 nights in soft release enclosures pre-release, and in situ supplementary feeding has been sustained to encourage site fidelity. Three months following the release, 19 individuals remain at the site. Captive-bred birds have shown far greater post-release site fidelity, with 11 of 14 (79%) still present, compared to 8 of 18 (44% wild-sourced individuals). One individual was detected returning the 30 km distance to Yellingbo. Nesting success is being monitored and further releases are planned for 2022.

Mikaeylah Davidson, The University of Melbourne

Investigation into embryo mortality in the critically endangered Southern Corroboree frog (*Pseudophryne corroboree*)

The Southern Corroboree frog (*Pseudophryne corroboree*) is one of Australia's most iconic amphibian species. Endemic to Mt Kosciusko National Park, its small alpine range has left it particularly vulnerable to habitat destruction, climate changes and infectious diseases.

Before the 1980's, *P. corroboree* were thriving. However, the introduction of the deadly fungus, chytridiomycosis, led to their decline, and almost extinction. But action was quickly taken to ensure the future of this species, and captive managed breeding colonies run by Zoos were established.

These days, there are over 1000 adults in captivity, breeding to produce the next generation of Corroboree frogs. However, captive breeding this cryptic amphibian has not come without its challenges. Since the beginning of the breeding program, colonies have experienced up to 100% mortality in embryos produced. And the cause of mortality up until now has been unknown.

For the first time, we investigated embryo development in captive bred *P. corroboree*. The aim, to see if disease was playing a role in the continued high mortality rates. We found that in embryos which showed signs of unhealthy development, more than 80% of those were plagued with unknown fungal infections. Identification of these fungi revealed two fungal genus which have never been isolated from amphibian embryos before. We also found a significant correlation with developmental malformations and mortality.

Work is currently being prepared for the upcoming breeding season to investigate the impact of husbandry changes to improve embryo survival in this captive bred, critically endangered amphibian.

Daniel Nugent, La Trobe University

Livestock production land and conservation areas play a complementary role in the conservation of a critically endangered grassland bird – the Plains-wanderer

Livestock production and biodiversity conservation are important uses of native grasslands in agricultural landscapes. Approaches to managing structural changes that result from climate cycles typically differ between production farms and conservation areas as they have different goals. This has the potential to shift habitat suitability for grassland fauna across landscapes.

The critically endangered Plains-wanderer (*Pedionomus torquatus*) is a habitat specialist that occurs on land managed for both livestock production and conservation in semi-arid grasslands of eastern Australia. It is unclear if habitat suitability for the Plains-wanderer is stable or shifts in response to interactions between different land uses and climate phases. Here we investigate if land use type (production, conservation) interacts with climate (rainfall) to affect habitat suitability of the Plains-wanderer using 11 years of bird occurrence and remotely-sensed habitat structure data.

We found habitat suitability for the Plains-wanderer was driven by an interaction between land use type and rainfall, with conservation areas supporting more high

value habitat during dry periods but less during wet periods. Plains-wanderer occurrence was also influenced by interactions between land use and rainfall, with birds more likely to occur at production farms during wet periods.

Our findings show how land used for livestock production can complement conservation areas in providing high value habitat for the Plains-wanderer. Furthermore, they highlight that land use type and climate are important drivers of grassland dynamics, and approaches to biodiversity conservation should consider that patterns of habitat suitability may shift across landscapes over time.

Emily Mathews, Federation University

Between a rock and a hard place: Site selection for Brush-tailed Rock-wallaby translocation

Despite advances in conservation management, the number of threatened species continues to rise globally. In Australia, since European colonisation, we have seen increased extinction rates and significant population declines for many species.

This project contributes to conservation of an iconic threatened species: Brush-tailed Rock-wallaby (BTRW) (*Petrogale penicillata*) by identifying potential release sites for captive-bred wallabies in order to support the establishment of new BTRW colonies in Victoria and the ACT.

Structured Decision Making (SDM) (Gregory et al. 2012) involving a panel of experts will be used to identify and rank key habitat attributes for BTRW. Highly ranked attributes will be used to create a habitat suitability model (HSM) for BTRW, employing Geographic Information System (GIS) methods, remote sensing data and Maxent software.

The HSM will facilitate identification of potential release sites. These sites will be ranked from most to least feasible by the expert panel through a second SDM process.

William Mitchell, Monash University

Are we adequately assessing the demographic impacts of harvesting for wild-sourced conservation translocations?

Much of biodiversity conservation contributes to one of two fundamental components: the preservation of existing biodiversity assets, or the restoration of those that have been degraded. Both are important, though given remnant

ecosystems often exhibit greater biodiversity value than comparable restored systems, preservation is often considered the greater priority.

Translocation, the human-facilitated movement of organisms from one area to another, is one conservation tool motivated by restoration. The focal point of any translocation study is invariably the release population, but it is crucial that recovery actions are not made at the expense of extant populations from which translocated individuals are sourced.

I conducted a structured review of literature addressing wild-sourced conservation translocation programs to determine what proportion of studies address the potential impact of harvesting from translocation source populations.

Only 11% of studies in our dataset explicitly assessed impact of harvesting on translocation source populations. Moreover, the proportion of studies that do estimate impact in a given year has not increased over a ten-year period. Based on these results, I propose a standardized framework for reporting on management of translocation source populations and provide two case studies as examples.

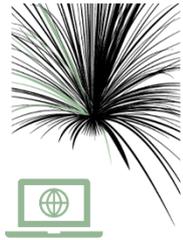
Routinely reporting impacts of harvesting on source populations will inform management when source sustainability is uncertain, improve transparency and increase the likelihood of successful conservation for the many threatened species offered a lifeline through translocation.

Hannah Roberts, La Trobe University

A novel method of oestrus detection in the captive Tasmanian devil (*Sarcophilus harrisi*)

Captive breeding is a critical conservation tool for the endangered Tasmanian devil (*Sarcophilus harrisi*). Unfortunately, captive devils experience poor breeding success compared with wild devils. Identifying the correct time to pair males and females is a challenge for breeding programs, with current methods being invasive, slow, or inaccurate. This study investigated the use of detection dogs as a novel method of oestrus detection in devils. The aims of this project were to: (1) train dogs to discriminate between oestrus and non-oestrus odours in devil faecal samples, and (2) test the ability of dogs to generalise oestrus scents from training samples to unfamiliar samples. Faecal samples were collected from five successfully paired, captive devils prior to and during oestrus. Two experienced detection dogs were trained and assessed on their ability to differentiate between oestrus and non-oestrus samples. Overall, the dogs were able to correctly identify oestrus 83.3% of the time (98.6% of the time for familiar samples and 72.2% for novel samples). One dog excelled in training but struggled to generalize an oestrus odour from the familiar samples to the novel samples. These results suggest that dogs can discriminate between oestrus and non-oestrus samples and are able to generalise oestrus scents,

but may need more training on additional samples to improve generalisation. This was the first study exploring the use of oestrus detection dogs for a captive wildlife species. This novel method of oestrus detection may provide a fast, cost-effective tool to improve breeding outcomes in the captive Tasmanian devil.



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Session 7: Adapting to Environmental Change **Friday 4th February, 10.45 am – 12.30 pm**

Iris Hickman, La Trobe University

Alpine shrub functional traits varies with altitude: what are the implications under climate change?

The distribution and survival of alpine vegetation are influenced by snowfall directly (thermal protection) and indirectly (growing season length). Plants living in alpine regions depend on snow for protection against high diurnal and microclimate variability in winter and early spring. However, with snow projected to significantly decrease with climate change, alpine species may adapt to changing conditions through phenotypic plasticity or genetic changes, i.e., morphological adaptations.

The natural variation of traits across environmental gradients can inform the adaptive potential of alpine species. This study investigates how elevation, and the associated changes in abiotic variables, influence plant traits (morphology) of alpine shrub, *Grevillea australis*, in the Australian alpine region.

Our results showed intraspecific trait variation associated with changes in elevation. For example, shrubs at lower elevations were taller and had thicker leaves, while at high elevations shrubs were shorter and had thinner leaves. These findings show a shift in ecological strategy in response to changing abiotic stressors. The trends observed demonstrate the potential role of phenotypic plasticity in response to environmental change. Trait plasticity is crucial for future climate change scenarios and may allow species to persist in the currently rapidly changing environment.

Dr Katherine Selwood, Zoos Victoria

Emergency conservation intervention for the Eastern Bristlebird during the Black Summer bushfires

Emergency conservation interventions (ECIs) will be increasingly necessary to prevent extinctions or severe population bottlenecks as extreme events become more frequent. We detail the emergency extraction of the endangered Eastern Bristlebird (*Dasyornis brachypterus*) during the unprecedented 2019-2020 Australian Black Summer bushfires; an action that led to rapid establishment of a temporary captive insurance population sourced from an area under immediate threat from bushfire (Croajingalong National Park, Victoria). The response was triggered, coordinated and implemented within a four-week period, with re-release to the wild within two months. We present this case study within a framework for ECIs, based on the emergency management phases of preparation, response and recovery.

Tobias Ross, Deakin University

The potential of wastewater treatment plants as alternative habitats - an assessment of contaminants, disease, health and survival of migratory shorebirds in natural versus artificial wetlands

The prime threats perceived to contribute to the global decline of shorebirds include climate change and habitat loss. Whereas the rate of destruction of natural wetland habitats has been particularly rapid over the past decades, artificial wetlands, including wastewater treatment plants, have seen an increase over this time. These new habitats, in turn, pose a pollution risk to wildlife. Here we compare exposure to metals, other elements and per/polyfluoroalkyl substance (PFAS) pollution, avian influenza prevalence and oxidative stress with local survival in two long-distance migratory shorebird species, curlew sandpipers (*Calidris ferruginea*) and red-necked stints (*Calidris ruficollis*), using two contrasting habitats while on their Australian non-breeding grounds: a natural wetland and a putatively more polluted artificial wetland at a wastewater treatment plant. We show minimal difference in pollution between each habitat, and negligible site effects on local survival. Our findings suggest that wastewater treatment wetlands, if managed properly, may provide an alternative habitat to these migratory species. In the face of widespread habitat destruction, these artificial wetlands may prove critical in curbing the decline of shorebird populations.

David De Angelis, Frogs Victoria

Myiasis in frogs from Victoria involving external parasitism by a chloropid fly

Myiasis, or the infestation of living animals by fly (dipteran) larvae that feed on living or necrotic tissues, is known to occur in a range of vertebrates including frogs. Globally, flies in four families (Calliphoridae, Chloropidae, Phoridae, and Sarcophagidae) are known to infest amphibians. Until now, only 11 fly species in the obligate frog-feeding chloropid genus *Batrachomyia* (subfamily Oscinellinae) have been known to cause myiasis in frogs within Australia. This talk addresses the first investigated instance of external parasitism of frogs by fly larvae in the country, involving a fly species in the same subfamily although different genus infesting the Southern Brown Tree Frog (*Litoria ewingii*). Unlike *Batrachomyia* larvae which feed subcutaneously, those of the fly involved here attach themselves externally, including on the trunk and hind limbs of the frogs. The rate of parasitism in the area of central Victoria surveyed appears to be low, with five larvae found on four frogs among 443 frogs sampled. Further study is needed to determine the life cycle and ecology of this parasite, as well as its impact on the host. Reports of external parasitism by fly larvae in New South Wales also require further investigation, although together with this instance, suggest the incidence of myiasis and diversity of flies causing the condition in Australian frogs is greater than currently realised.

Dr Jennifer Hetz Rodriguez, Museums Victoria

The Ian Potter Australian Wildlife BioBank: working on safe-guarding the diversity of Victoria's wildlife for the future

Many of Victoria's animals are at risk of extinction due to disease, habitat lost, climate change and bushfires. Victoria has already lost 24 vertebrate animal species including 18 species of mammal, 2 birds, 1 snake and 3 freshwater fish. When a species goes extinct, vast amounts of information about their biology, ecology and evolutionary history is irreplaceably lost. To prevent this loss of genetic diversity information, in 2014 The Ian Potter Australian Wildlife BioBank was established in Museums Victoria. The Ian Potter Biobank is working hard to halt the loss of biodiversity by ensuring that all biological material that has been collected from threatened animal species is properly curated and used responsibly and sustainably in conservation, management, and research. Currently the Ian Potter BioBank holds 21,559 samples from different Victoria's wild species. These samples represent 892 species of a total of 1,370 animals in Victoria including mammals, birds, freshwater and marine fish, reptiles, and amphibians. Many of these samples include species classified as vulnerable, endangered, or critically endangered such as the Brush-tailed Rock-wallaby (*Petrogale penicillate*). Because the opportunity to protect genetic and biodiversity resources is time-sensitive, the Ian Potter Biobank is now working on the feasibility of expanding to cryopreservation of live cells of threatened species in Victoria, such as sperm and cell cultures. These live cells can potentially

be used in future conservation breeding programmes or diversify the gene pool in wild populations and prevent loss of genetic diversity and species extinction.

Danielle Eastick, La Trobe University

Braving the storms ahead: are microbats good bioindicators for climate change?

Reproductive phenology, size at birth and postnatal growth are important life history traits that reflect parental investment. The ability to document changes in these traits in the face of anthropogenic disturbance can be a valuable tool in the identification and management of at-risk populations. We examined reproductive phenology, size at birth and postnatal growth in a widespread, common Australian microbat, *Chalinolobus gouldii* at two sites over two years and derived growth curves and age estimation equations which will be useful in the study of how intrinsic and extrinsic factors alter parental investment strategies. We found that male and female offspring did not differ significantly in their size at birth or their postnatal growth rates. Bats born in 2018 were smaller at birth but grew at a faster rate than those born 2017. When date of birth was compared across sites and years, we found bats born in 2018 had a later median birthdate (by 18 days) and births were more widespread than those born in 2017. Cooler and wetter weather during late gestation in 2018 likely prolonged gestation and delayed births. As bats gain popularity as bioindicator species for environmental change it is important to study the impacts of climate change on reproduction in common and widespread 'model' species, which may assist in the conservation and management of threatened microbats with similar reproductive traits.

Session 8: Behavioural Ecology
Friday 4th February, 10.45 am – 12.10 pm

Ettore Camerlenghi, Monash University

Cooperative breeding and the emergence of multilevel societies in birds

Multilevel societies (MLSs), where social levels are hierarchically nested within each other, are considered one of the most complex forms of animal societies. Although thought to mainly occur in mammals, it is suggested that MLSs could be under-detected in birds. Here we propose that the emergence of MLSs could be common in cooperatively breeding birds, as both systems are favoured by similar ecological and social drivers. We first investigate this proposition by systematically comparing evidence for multilevel social structure in cooperative and non-cooperative birds in Australia and New Zealand, global hotspots for cooperative breeding. We then analyse non-breeding social networks of cooperatively breeding superb fairy-wrens (*Malurus cyaneus*) to reveal their structured multilevel society, with three hierarchical

social levels that are stable across years. Our results confirm recent predictions that MLSs are likely to be widespread in birds and suggest that these societies could be particularly common in cooperatively breeding birds.

Cassie Speakman, Deakin University

Fear vs. Food: Exploring behavioural and population-level responses to environmental change and predation pressure in Australian fur seals

Understanding how wild animals respond behaviourally to changes in their environment can be a crucial factor in predicting how vulnerable a population is to change. It can be challenging, however, to understand when behavioural changes are biologically meaningful at the population level, particularly for long-lived or cryptic species. State-dependent life-history theory models implemented via stochastic dynamic programming (SDP) have been used to explore these linkages by identifying the optimal choices of an individual in the context of its own physiology and the state of the environment, allowing us to explore how conditions outside of the norm impact behaviour. Here, we developed an SDP model using Australian fur seals as a case study to investigate the individual and combined effects of changes in predation risk and prey availability on reproductive and behavioural decisions and ultimately population dynamics on this long-lived predator. We show how predation risk influences when individuals return to land and how this varies with individual condition. While prey availability also influenced behavioural decisions, it had a greater influence on the reproductive success of females. With climate change driving shifts in the distribution and abundance of marine species at all trophic levels, it's important to understand how such shifts may impact endemic species such as the Australian fur seal.

Marty Lockett, The University of Melbourne

Artificial light at night impacts a woodland food chain at every level

Natural light governs many ecological processes, including phenological events, animal behaviour, plant morphology and photosynthesis. Artificial light at night (ALAN) can interfere with these processes, with cascading impacts on ecological communities. We explored potential ALAN-mediated cascades in a model trophic community comprising a Eucalyptus host tree (river red gum), a specialist herbivore (lerp psyllid) and a psyllid predator (bell miner). We cultivated red gum saplings under streetlight-level ALAN and control conditions over 40 weeks, and colonised them with lerp psyllids. We measured tree growth, physiology (photosynthesis, water status) and morphology (leaf and root investment, leaf morphology), and monitored psyllid success at five key life stages. We also used direct observations and bioacoustics to monitor the effect of ALAN levels on bell miner foraging activity. All

three levels of the trophic community were disrupted by ALAN. River red gums photosynthesized at night, and shifted leaf morphology and investment in response to ALAN. Psyllid life cycles were unaffected, but lerp productivity increased. At the most ALAN-impacted sites, bell miner activity cycles became de-coupled from natural lunar cues, and overall foraging activity increased sharply. Our results suggest that ALAN is likely to have both top-down and bottom-up impacts on important woodland food webs. Given the importance of lerps as a food resource for many birds and other animals, ALAN-mediated trophic effects may impact a wide variety of fauna (and host trees) in urban woodland communities.

Meg Farmer, Deakin University

Population ecology and movement of the long-nosed potoroo, *Potorous tridactylus*, on French Island, Victoria

A key threat contributing to the global extinction crisis is the introduction and impacts of invasive predators. Effective large-scale lethal control is often not logistically or financially feasible, so alternative solutions to promote survival of wildlife most vulnerable to predation—critical weight range mammals—must be sought. Studying the habitat use and selection of native prey persisting under predation pressure by common invasive predators increases understanding of which habitat elements may promote survival, informing management priorities. We established a trapping grid on French Island, Victoria, and deployed GPS tracking devices (igot-U), to collect morphometric, demographic, habitat use and movement data for the resident long-nosed potoroo (*Potorous tridactylus*) population. We used spatially explicit capture-recapture models to generate a potoroo density estimate and a dynamic Brownian Bridge Movement Model to estimate individual activity ranges. Subsequent overlap and K-select analyses were used to quantify habitat use and draw inferences about habitat selection and territoriality. Potoroos persisted at low densities, with large activity ranges. Individuals selected for structurally complex habitat and appear reluctant to move across open areas, potentially perceiving and responding to variable predation risk. Our fine-scale movement data provides key information on potoroo reliance on vegetation structure, suggesting that maintaining habitat cover and connectivity is likely to aid potoroos and similar species to co-exist with cats. Particularly, given the ongoing threat feral cats pose to biodiversity, we discuss how the results of this study can help inform more targeted management actions and better conservation outcomes for native wildlife co-occurring with introduced predators.

Danielle Wallace, The University of Melbourne

The unexpected effects of wildlife disease – investigating the impact of chytrid fungus on the breeding display of Victorian frogs

Following widespread declines and extinctions caused by the wildlife disease, chytridiomycosis, some amphibian species are persisting with and recovering from infection. Unexpectedly, some species can increase their reproductive effort to counteract disease-induced mortality through terminal investment. Terminal investment can occur in many animals, and might explain how some frogs persist – by increasing reproduction to balance mortality caused by chytridiomycosis.

To test how male breeding behaviour is influenced by infection, we investigated the advertisement calls and breeding colouration of the declining and endangered alpine tree frog, *Litoria verreauxii alpina* and compared the call and colour characteristics of infected males to those that were healthy. We recorded frog calls in the field during the peak breeding season in the Victorian alps and used a spectrophotometer to analyse colour parameters of male alpine tree frog throat patches. We swabbed frogs for infection and then analysed the call and colour characteristics of infected and uninfected frogs to determine whether infection affected breeding displays in the alpine tree frog.

Disease impacts on reproductive output and recruitment are understudied, but can lead to potentially significant outcomes of wildlife disease emergence. Differences in breeding success and reproductive effort might have dramatic consequences on population trajectories and substantially influence population decline or recovery potential. It is crucial that we determine how threatened and declining frogs are responding to disease, to ensure that management compliments the mechanisms of population resilience.

Abigail Robinson, Monash University

Manipulating breeding female quality reveals subtle helper effects in a cooperatively breeding bird

Although a major assumption of hypotheses used to explain the evolution of cooperative breeding, helper benefits to breeders are often hard to detect. Variables such as breeder quality can confound helper effects on breeder fitness. I manipulated breeding female quality in the superb fairy-wren (*Malurus cyaneus*) by clipping wing feathers to increase flight costs. To females with and without helpers I randomly assigned clipped and control treatments and collected data on their reproductive investment and output. Clipped females laid lighter eggs and provisioned nestlings less than control females. Females with helpers laid heavier eggs than those without helpers but showed no difference in provisioning rates, suggesting helpers might have a role in mitigating the negative effects of clipping

on reproductive success. This research indicates that helper benefits might manifest at low levels at different stages in the reproductive cycle, and that manipulation of breeder quality via wing clipping allows detection of these subtle effects.

Kelly Williams, La Trobe University

The bold or the beautiful: Does personality impact translocation success in a vulnerable rodent?

Investigations into the existence of 'personalities' in non-human animals have increased substantially in the last decade. There is now widespread support that individuals possess their own unique, yet predictable and consistent, variations in behaviour. Despite the acknowledgement that personality must have fitness consequences, we are still discovering how individual traits influence survivorship and reproductive success. It has been suggested that riskier (i.e., bolder and more exploratory) behavioural types may achieve higher reproductive success but suffer greater survival costs, highlighting a risk-reward trade-off. Accordingly, my PhD research investigates how personality influences survival in a threatened native rodent, the greater stick-nest rat (*Leporillus conditor*). I am investigating two populations, one captive bred at Monarto Safari Park and released in Mallee Cliffs National Park NSW, and the other wild-caught and released on Dirk Hartog Island WA. I have conducted personality assessments on the captive bred rats including temperament, open field, mirror, and predator scent trials, while the wild individuals were temperament assessed. I am also interested in how physiology relates to personality and survival, so I will be conducting hormone analysis on faecal samples from all individuals. Post-release monitoring of both populations is now underway. Understanding how personality and physiology affects survival can help inform future releases and ultimately, improve the conservation outcomes for this wonderful native species.

Session 9: Terrestrial Diversity & Ecology (2)
Friday 4th February, 10.45 am – 12.30 pm

Jules Farquhar, Monash University

Geographic colour pattern variation in the varanid lizard (*Varanus varius*) is associated with climatic niche divergence along a mesic–arid gradient

In wide-ranging taxa occupying diverse climate gradients, alternative colour pattern variants may emerge as an adaptive response to local climatic regimes. I explored patterns of geographical segregation among colour morphs of the Lace monitor *Varanus varius* and determined whether morphs occupy divergent climatic niches along a mesic–arid gradient. I compiled a dataset of crowdsourced, georeferenced

photographic records ($n = 1,637$) of *V. varius* and scored each as one of two discrete colour pattern phenotypes — Lace morph (mostly dark with fine pale patterning) or Bell's morph (broad yellow and black bands). I tested for geographic segregation of colour morphs using exploratory point-pattern process analysis, then tested for differences between each colour morphs' realised climatic niche. While both morphs co-occur over much of the species' range, there is a coastal–inland clinal transition in the relative densities of the morphs' occurrences — the Bell's morph becomes the more prevalent phenotype towards inland locations and is rare or absent towards coastal regions. Climate niche analysis shows that the Bell's morph exploits areas that are relatively more arid, receive more solar irradiation, and experience a broader range of thermal extremes than those occupied by the Lace morph. The mesic–arid transition zone in eastern Australia appears to be a primary axis of environmental variation over which geographical variation in colour polymorphism has emerged in *V. varius*. This study supports long-held speculation that the Bell's morph is predominantly an arid phenotype, providing a foundation for future research into its specific adaptive functions in arid environments.

Emily Scicluna, La Trobe University

Little whip snakes show seasonally influenced habitat preference: implications for surveys and monitoring

Roof tiles are commonly used for surveying small terrestrial fauna, including small mammals, invertebrates and reptiles. This method is particularly useful in (critically endangered) basalt grasslands, because it is less invasive (to both fauna and the ecosystem) than other techniques (i.e., pitfall trapping), and allows the animal to come and go freely when not being held by a researcher. We surveyed 180 terracotta roof tiles and 250 rocks one day per month during 2019 at Western Treatment Plant (Werribee, VIC). Tiles were laid 6 months prior to surveying. Little whip snakes (*Suta flagellum*) showed clear seasonal differences in habitat preference with increased tile use during September and October. We emphasise the importance of carefully planning the timing of surveys for this species, and illustrate that, depending on the objective, artificial habitat survey methods may be adequate during periods of optimal detection likelihood, however they are likely not sufficient to obtain population estimates or answer questions on temporal fluctuations.

Claire Tingate, Deakin University

Arboreal mammal distribution, abundance and diversity in roadsides of the Strathbogie Ranges, Victoria

Modified linear habitats, such as roadsides, are critically important for biodiversity and off-reserve conservation. Remnant roadside vegetation complements much larger areas of habitat and facilitates connectivity and species movement across

fragmented landscapes. We spotlight surveyed 30 stratified, randomly selected 500 m roadsides, throughout the Strathbogie Ranges in northeast Victoria, Australia, to determine the distribution, relative abundance, and diversity of six arboreal native mammal species, and identify site- and landscape-level factors influencing these species among roadsides. We found that arboreal mammals were common and abundant throughout roadsides (mean species abundance at sites 3.6-16), indicating they serve as important habitat for arboreal mammals, including koalas, bobucks and common brushtail possums, Krefft's gliders, and common ringtail possums. Greater gliders were much less common than we anticipated, present at only 13% (4/30) of sites. This may be indicative of their more specialised habitat requirements, and highlights the high value of roadsides in which this threatened species persists. The relative abundance of species at the site-level was influenced by habitat preferences and resource availability. Notably, species abundance and diversity were generally greater at roadsides with less surrounding forest cover, suggesting mammals are using and reliant upon high-quality habitat within roadsides. Furthermore, Acacia and symphyomyrtle eucalypt abundance in roadsides was associated with increased arboreal mammal diversity. Our study demonstrates the significant biodiversity values of roadside vegetation for arboreal mammal conservation, including threatened species, and hence, we recommend they are protected and managed carefully as part of integrated on- and off-reserve wildlife conservation and landscape management.

Amanda Locascio, The University of Melbourne

Does context matter? microbat distributions in fragmented, fire-prone landscapes

In many fire-prone ecosystems prescribed burning is used for ecological management. However, there are clear gaps in knowledge about the capacity of prescribed burning to achieve biodiversity conservation goals in already fragmented landscapes. Variation in the availability of resources due to disturbance create opportunities for different suites of species. The functional traits of species utilising those resources should direct the response to ecological disturbances such as fire and fragmentation because they determine how an organism interacts with their environment.

To understand how disturbance regime, habitat structure, and site-scale variability influence species community structure, we examined the effect of prescribed burning on a microbat assemblage across fire-prone and fragmented landscapes. We surveyed microbats using acoustic monitoring (138 sites) and harp- and mist-net trapping at (141 sites), in southwestern Victoria and south-eastern South Australia. Sites were selected to represent the variation in time since fire and habitat connectivity. We collected and analysed 687,377 acoustic recordings containing 4,825,669 calls from 13 species using a combination of machine learning and manual post-validation models.

Our study revealed new insights into how landscape context and disturbance history interact to affect microbat community composition and structure.

Jo Stubbs, The University of Melbourne

How does the environmental volunteer group Friends of the Prom conduct ecological restoration of Yiruk/Wamoon, under the permits, regulations and permissions of Parks Victoria?

Established in 1979 and located at Yiruk / Wamoon (Wilson's Promontory National Park) on Gunaikurnai, Bunurong and Boon Wurrung Country, Friends of the Prom is a volunteer run, not for profit which conduct ecological restoration works under the permits, regulations and permissions of Parks Victoria.

They engage the public through the Parks Victoria platform to organise volunteer days, such as weed removal of Sea Spurge (*Euphorbia paralias*) from Prom beaches to restore habitat for Hooded Plover (*Thinornis rubricollis*), beach rubbish removal and documentation, scat counting on the Yanakie Isthmus and population counts of Orange Bellied Parrot (*Neophema chrysogaster*), Hooded Plover (*Thinornis rubricollis*) and other shorebirds.

At the Tidal River Nursery, they conduct seed and cuttings collection of prom indigenous plants to ensure local seed provenance and genetic integrity, which are then stored or propagated for ecological restoration projects, such as planting and guarding of Swamp Gum (*Eucalyptus ovata*) to restore Strzelecki/South Gippsland koalas' habitat.

They collaborate with organisations to conduct science research projects, such as the Victorian National Parks Association on Grass- tree dieback caused by water-borne pathogen Cinnamon Fungus (*Phytophthora cinnamomi*), and Strzelecki Koala Action Team to create the "Strzelecki Koala Map" of Strzelecki/South Gippsland koala activity.

Madeline Barker, Deakin University

Non-breeding habitat selection of a sandy shore obligate shorebird

The temporal partitioning of species' life history phases according to seasonal environmental variation is pervasive, yet most habitat selection studies have focussed on breeding rather than non-breeding periods. I have examined habitat selection of a non-breeding, resident shorebird (the Hooded Plover *Thinornis rubricollis*) on a southern hemisphere, high energy shoreline. I identified and described differences in beach form and composition as they related to the four

distinct kinds of non-breeding habitat occupation: flocking sites, year-round territories, breeding season only territories, and sites not occupied by hooded plovers (no bird sites). I measured 36 potentially important habitat variables in a Geographic Information System (GIS) and analysed these using multinomial regression following variable selection (Least Absolute Shrinkage and Selection Operator [LASSO]). Flocking sites were characterised by having south-facing beaches and were closer to the nearest breeding territory than no bird sites. Year-round territories had closer nearer neighbours than no bird sites and were typically at southwest facing beaches. Breeding territories that were unoccupied during the non-breeding period had less available swash area (a key foraging zone), were further from the nearest breeding territory and were typically southwest facing. No bird sites were further from nearest neighbouring breeding territories and typically faced southeast. These factors are likely driven by social and ecological factors (i.e., foraging habitat and ecological productivity). Thus, my research has identified priority sites, beach types and habitats that warrant protection and demonstrated the importance of considering habitat selection across the full lifecycle for the conservation of threatened species.

Kevin Newman, The University of Melbourne

An Analytical Solution for Optimising Multi-Species Detection Surveys

When undertaking surveillance for multiple species the probability of detecting each species at a site for a given level of survey effort is rarely 1. As such, there is a trade-off between the number of sites to survey, and the survey effort per site. Conservation budgets are limited, and inherent costs of surveying need to be considered to ensure that survey design is optimal to meet required objectives. These costs can be simplified into two categories, site establishment costs and the cost of visiting, surveying or processing a site after establishment.

