Bob Croser Woodland Recovery Supplementary Scholarships

PhD Projects

PhD 1. Promoting management and policy to protect and regenerate woodland birds in the Mt Lofty Ranges

The Mt Lofty Ranges, covering approximately 500,000 hectares in South Australia, faces significant ecological challenges due to development pressures, vegetation loss, habitat fragmentation, edge effects, invasive species, and altered fire and water regimes. Without urgent interdisciplinary intervention that addresses both ecological and social dimensions of conservation, many specialist woodland bird species face regional extinction within the next few decades, representing an irreversible loss of biodiversity and ecosystem function. To generate scale responses sufficient to halt the decline and work to regenerate populations of woodland birds in the Mt Lofty Ranges it will be necessary to develop new, stronger ecological management outcomes across regional landscapes.

The PhD researcher would examine how habitat areas in the Mt Lofty Ranges can be designed, protected, promoted and managed effectively in the long term to regenerate woodland bird populations. Development pressures, including ongoing losses of vegetation, fragmentation, edge effects, invasive species, changed fire and water regimes and other forced changes make it very difficult for species with specific habitat requirements and limited tolerance for disturbance, competition or predation to retain or build populations. The research would involve engaging with and surveying landowners, Indigenous knowledge holders, conservation groups, and planning authorities to determine gaps and opportunities for improvements in planning and management in relation to development pressures and a changing climate. Depending on the skills of the successful applicant, some of that work could have a focus on analysing existing habitat patches to assess their quality and connectivity in relation to other land uses using landscape architecture spatial analysis techniques. The critical analysis of policy and management gaps and opportunities will aim to bridge the gap between ecological science and practical conservation implementation by developing recommendations to guide future, targeted landscape management policy.

Supervisors: Douglas Bardsley and Scott Hawken

PhD 2. The socio-ecology of Rebirding the Ranges

The rebirding of the ranges will require parts of the landscape to be utilised primarily for biodiversity conservation or for regeneration of habitat. People will understand that such a shift will provide a range of benefits for their landscapes, their communities and for the environment more generally. However, there will also be numerous costs or risks associated with a comprehensive bird conservation strategy, such as the significant opportunity costs of not using land for immediately productive uses such as housing or agriculture.

This PhD project would undertake a whole-of-system socio-ecological analysis of the values and costs/risks of designing, conserving and managing landscape to promote the conservation of rare and threatened bird species across the Mt Lofty Ranges. Data analysis would focus on a perceptions survey, but could also include economic methods. All direct and indirect services and disservices of the proposed change in landscape would be examined based on the perceptions of landscape managers and the broader community in the attempt to comprehensively identify all the costs and values of the activity.

Supervisors: Douglas Bardsley, Irene Martin-Fores

PhD 3. Next-generation monitoring of woodland bird populations in the Mount Lofty Ranges

The Mount Lofty Ranges (MLR) are a hotspot of biodiversity with national significance. Although remnant woodland ecosystems in the MLR still provide an important refuge for birds, the abundance of large-bodied, aggressive and/or generalist species is increasing while many woodland-specialist species are declining. This PhD project will assess the evidence for and drivers of bird population trajectories in the MLR and develop acoustic methods for monitoring bird assemblages.

Aim 1: To provide the most up-to-date picture of distributional shifts and trends in abundance for individual species and different bird functional groups. This component will synthesise available long-term data on MLR woodland birds, sourced from dedicated monitoring programs and citizen-science datasets. Models that link species occurrence/abundance to a range of environmental, biological and management factors will be developed. Key results will include: (a) updated population size estimates for target species in the MLR; and (b) improved understanding of how woodland birds are being impacted by climate change, fire regimes, management of feral predators and herbivores, and changing land-use practices.

Aim 2: To develop acoustic monitoring methods for rare and cryptic species. The rarity and/or cryptic nature of some woodland bird species means they are rarely observed by traditional monitoring programs or citizen scientists. Following recent advances in acoustic monitoring for the threatened Bassian thrush population in the MLR, acoustic recognisers will be developed to automate the detection of target species' calls from audio recordings. With a focus on woodland bird species for which available survey data are lacking (e.g., Chestnut-rumped heathwren), arrays of acoustic recorders will then be deployed to study occupancy and habitat selection in these species.

Aim 3: To validate acoustic 'soundscape' methods for monitoring bird assemblages in the MLR. Monitoring wildlife remotely through soundscapes is gaining prominence in the global scientific literature but requires quality survey data for validation. The MLR woodland bird monitoring program monitors bird abundance and diversity annually at a core set of 151 woodland sites and is one of the most significant ecological monitoring programs available in Australia. This component will deploy acoustic recorders at established monitoring sites, validate a workflow for detecting multi-species presence from acoustic data, and explore relationships between bird call frequency and species abundance counts. A citizen science project could be undertaken to encourage landholders in the MLR to monitor soundscapes on their properties and stimulate community interest in woodland bird conservation.

Supervisors: Thomas Prowse, Patrick O'Connor, Rebecca Boulton

PhD 4. Climate-resilient Mount Lofty Ranges: supporting plant biodiversity under heat, drought, and fire extremes

This is one of two PhDs aimed at helping maintain quality habitat and vegetation as the essential backbone for the Rebird the Ranges program. This PhD project will utilize a combination of ecophysiological, functional and community ecology approaches to forecast likely changes in vegetation, functionality, and overall habitat quality.

The project will investigate the tolerances of plant communities in the Mount Lofty Ranges (MLR) to heat, drought, fire, and invasive species. Determining the tolerances of plant communities to these stressors, acting individually and interactively, will be required to predict vegetation responses to future climate change and to implement restoration practices towards higher ecosystem resilience. Functional traits can be related to environmental variation and plant strategies and adaptations, and they will be used to investigate plant tolerances to these multiple stressors. You will be based in a lab group that prioritises being supportive and inclusive in the pursuit of excellence and applied outcomes*:* This project will require working across disciplines and across institutions.

Goals:

- Identify key plant species for habitat quality and biodiversity, and invasive species already present in the MLR.
- Quantify the tolerances to heat, drought, and fire for key plant species and communities across the MLR.
- Derive recommendations for conservation and restoration

Proposed Methods:

- Identify plant species that are key to retaining habitat quality and biodiversity in the MLR (e.g. dominant species, keystone species providing habitat and food for birds). This will be done using literature, consultation with experts, and novel data collection. Existing long-term monitoring data from various sources will be used to investigate the distribution of these key plant species in the MLR.
- Identify invasive species posing a threat to habitat condition.

- For each key native or invasive plant species identified above, collate functional traits from global and national plant trait databases to identify gaps and undertake preliminary analyses, with a focus on traits related to heat, drought, fire tolerance, and palatability to grazers.
- Fill data gaps through gap-filling approach (where appropriate) and collecting novel trait measurements.
- Upscale species-level data to vegetation communities in the MLR using community weighted means and network visualisation (nestedness, cohesion and species interactions)
- Use functional trait data to predict changes to vegetation communities and to improve restoration guidelines under future climate change.

Expected outcomes: This project will result in at least three peer-reviewed papers in high-impact journals and will generate fundamental knowledge and management recommendations for increasing the climate-resilience of MLR vegetation (e.g. more heat-, drought- and fire-resistant revegetation).

Supervisors: Gunnar Keppel, Ilaine Matos, Irene Martín-Forés, Andy Lowe

PhD 5. Climate succession in the Mount Lofty Ranges: a landscape approach to managing vegetation change

This is one of two PhDs aimed at helping maintain quality habitat and vegetation as the essential backbone for the Rebird the Ranges program. This PhD project will use diverse modelling approaches to understand past and likely future changes in the vegetation at the landscape scale.

As the impacts of climate change intensify, vegetation across landscapes will change as current ecological communities are displaced by others that are better adapted to the new conditions. This process has been termed climate succession. In the Mount Lofty Ranges (MLR), heat, drought and fire, together with biological invasions, are likely key drivers of climate succession. Understanding the impact that these key drivers, together with grazing pressure, had over the last decades and will likely have in the future is key to effectively managing landscapes under climate change. Extreme weather events, such as intense heat waves during prolonged drought, are likely to play a key role in affecting climate succession and can lead to more intense wildfires. They will also disproportionately impact the success of restoration efforts. Including the likely impacts of extreme events in conservation planning therefore is important. This project will develop an understanding of the likely climate succession processes and impacts of extreme events in the Mount Lofty Ranges (MLR). Findings will be used to propose conservation strategies to address these, both for native vegetation and restoration efforts.

Goals:

- Investigate the impacts of recent (within the last 2 decades) extreme events on the vegetation of the MLR.
- Assess the effectiveness of current resilience-focused revegetation strategies in response to extreme climate conditions.
- Model future distributions of native vegetation taking into account invasive species, wildfires, and extreme weather events under likely future climate scenarios.
- Model future risks of plant heat-, drought-, and fire-induced mortality and likely changes in community composition.
- Forecast suitable areas for native vegetation and restoration planting that will support the long-term persistence of biodiversity.

Methods:

- Identify extreme events in relation to heat, drought and fire and their interactions.
- Use satellite imagery, with TERN and Bushland Condition Monitoring data, to identify mortality and recovery in native vegetation and revegetation efforts after extreme events.
- Use the functional traits from PhD 6 project to parameterise mechanistic models to assess the risk of heat-, drought-, and fire-induced plant mortality under future climate scenarios to determine the vulnerability of ecological communities and project their future distribution.
- Predict the likely impact of invasive species and wildfires on native communities and revegetation efforts using distribution models and functional traits.
- Integrate the accumulated knowledge to develop a climate succession model (without intervention) for the MLR.
- Derive key conservation actions that will avoid detrimental outcomes and identify key areas for climate-resilient restoration using the trait-based mechanistic models.

Expected outcomes: This project will result in at least three peer-reviewed papers in high-impact journals and will generate fundamental knowledge and management recommendations for increasing the climate-resilience of MLR vegetation (e.g. landscape-level planning for climate succession).

Supervisors: Irene Martín-Forés, Ilaine Matos, Gunnar Keppel, Bertram Ostendorf or Sami Rifai or Stefan Peters (TBD), Andy Lowe