ARI Terrestrial Quarterly Update

November 2021

About us

The Arthur Rylah Institute's terrestrial ecology teams produce high-quality science to support evidence based decision-making by governments and communities.

Our 45 scientists have extensive expertise in fauna and flora research, ecological modelling and data interpretation. We work collaboratively with national, state and local agencies, universities and the community.

Shaping effective management of wild dogs

Wild dogs – a catchall for dingoes, feral domestic dogs and dog-dingo hybrids – are linked to stock losses in Australian agriculture.

ARI research is quantifying the impact of wild dogs on the agricultural industry, evaluating the efficiency of control measures, and developing guidelines for effective wild dog control.

To do this ARI's Carlo Pacioni has developed **an individual-based, spatially explicit model** to investigate predator population dynamics and their response to various management strategies. This model includes important elements of wild dog social behaviour (such as pack dynamics) and was used to inform two recent publications:

- **Exploring the value of predator-exclusion fences**.
- **Modelling the interaction of wild dog individuals with control devices**

The issue of wild dogs as a threat to agriculture is complex as it spans social, cultural and environmental considerations. This body of work is delivering evidence to reliably forecast the future of wild dog populations in response to a variety of management actions. This will reduce the threat of wild dogs to agricultural assets with efficient and effective management strategies.

Wild dogs at a predator-exclusion fence (Carlo Pacioni)

News

Impact of recent bushfires on cryptic and threatened fauna

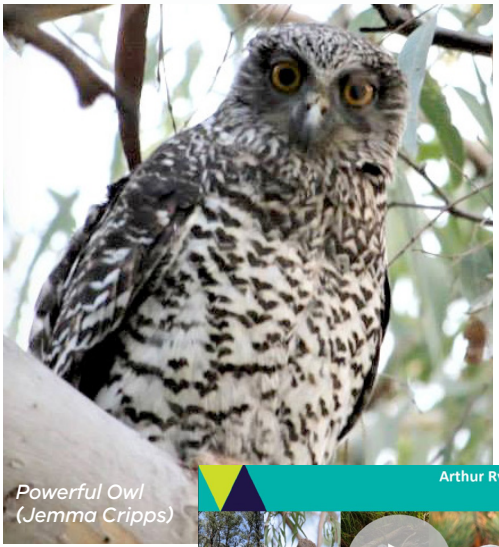
The recent megafires affected 1.5 million hectares of Victorian bushland. The response to these devastating fires was rapid with the Victorian and Federal governments funding research to understand the impact of the megafires on biodiversity through the **Bushfire Biodiversity Response and Recovery Program**. As part of the Program, funding was allocated to assess the short-term impacts of the megafires on many different fauna and flora – including bees, gliders, and owls. This information is being used to inform post-fire management and improve preparedness for protecting biodiversity during future fire events.

Epicormic regrowth following bushfire (Jemma Cripps)

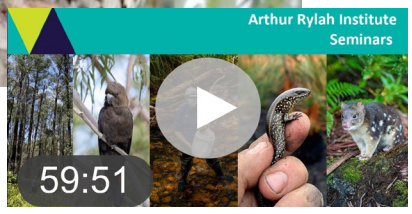
Bees

Bushfires modify available habitat and diminish resources (for example flowers and nesting sites) for pollinating invertebrates; however, relatively little is known of the impacts of fire on bee populations in Victoria. ARI's Matt Bruce, Dave Bryant, and Museums Victoria's Ken Walker, **investigated the impact of the bushfires on native bee diversity** and how particular types of bees (for example ground-nesting and above-ground nesting bees) responded to the bushfires. The researchers demonstrated that native bees were negatively impacted by the bushfires and that above-ground nesting bees may have been particularly impacted through loss of nesting habitat.

A Reed Bee (Ken Walker)



Powerful Owl (Jemma Cripps)



Gliders and Owls

Bushfires can lead to significant loss of old or dead trees. These trees provide critical habitat for several species that rely on tree hollows. By overlaying the extent of the fires with the known habitat of Victorian fauna, five hollow-dependant species were identified as being at risk of significant decline: Southern Greater Glider, Yellow-bellied Glider, Powerful Owl (pictured), Sooty Owl and Masked Owl. A team of ARI researchers – led by Jemma Cripps – conducted **surveys for the gliders and owls to assess short-term impacts and threats associated with the bushfires**. Their work highlighted the impact of high-severity fire on these species and the importance of protecting remaining unburnt forest habitat for gliders and owls in East Gippsland.

The **Bushfire Biodiversity Response and Recovery Program** is a large body of work that considers many aspects of Victorian biodiversity, including post-fire assessments for several frogs, reptiles, fish and other birds and mammals. Many aspects of the program were highlighted in a recent **ARI seminar**.

Influencing Change

Knowledge

Identifying research priorities to improve outcomes of management interventions in Victoria

Knowledge of how management actions will benefit biodiversity are needed to ensure more species, across more landscapes, benefit from our environmental investments. However, in many cases uncertainties exist regarding the effectiveness and value of conservation management actions in Victoria. To address this uncertainty, it is important to gain a better understanding of how various ecological systems respond to management actions.

To build a common picture for both researchers and environmental managers, the **Biodiversity 2037 Knowledge Framework** drew on the collective experience of experts (i.e. researchers and practitioners) to document the current understanding of various ecological systems, and to identify research priorities (i.e. key knowledge gaps).

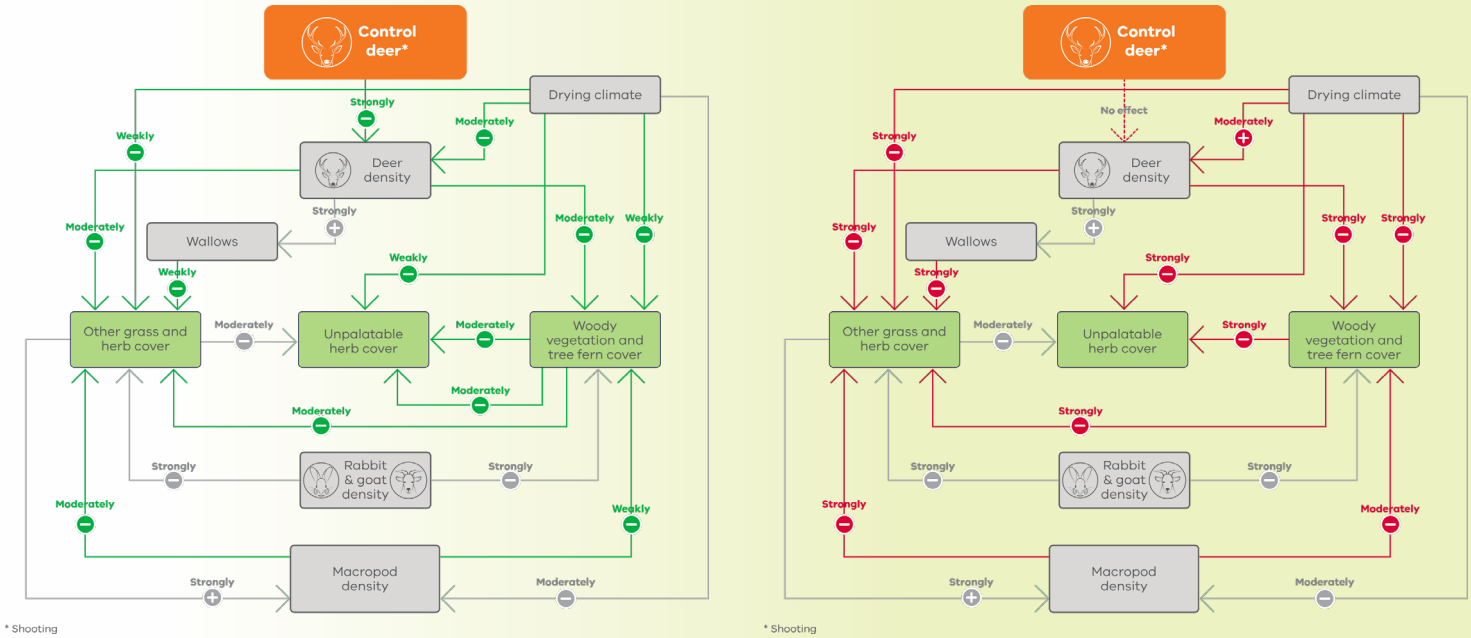
The resulting Framework depicts a series of causal models demonstrating how experts predict how management actions will influence biodiversity outcomes. Each model indicates the level of strength and certainty for each relationship in each model (an example for deer control is shown below). This information sets out DELWP's research priorities and can also be used to guide research commissioned elsewhere.

Based on the model, deer wallows (pictured) have a strong positive association with deer density (high certainty), but the negative effect of wallows on grass and herb cover is uncertain (photos ARI)

The **Knowledge Portal** is an interactive repository for all causal models which can be accessed and explored by anyone who is interested in how DELWP prioritises investment in knowledge. Over time, models will be updated to reflect contemporary knowledge and user comments.

Addressing these research priorities will increase confidence that the management actions being invested in will best support and conserve biodiversity in Victoria.

This project was a partnership between ARI (Matt Bruce), DELWP's Biodiversity Strategy and Knowledge Branch (project lead Anne Buchan) and the University of Melbourne (Libby Rumpff and Terry Walshe).



Alternative versions of the deer control causal model. Uncertain links are coloured green (best case scenario) or red (worst case scenario), grey links have high certainty according to experts.

Influencing Change

Ducks and Survey techniques

Setting sustainable harvest rates for game ducks

The setting of harvest rates for game ducks is important so that hunting does not cause unsustainable declines of native duck species. To achieve this, an estimate of population abundance for each duck species is required before each hunting season. This information enables the **Game Management Authority** to set sustainable harvest rates each year.

ARI's Dave Ramsey used Monte Carlo techniques to **examine different survey designs** for populations of game ducks on Victorian wetlands that gave abundance estimates for each species with acceptable precision. Following this, a **pilot aerial survey of game ducks was undertaken** from ~650 wetlands across Victoria to "road test" the preferred survey design. The pilot study provided the first robust estimates of the abundance of game ducks across Victoria.

The Game Management Authority is now equipped with recommendations that will guide sustainable harvest rates for game duck species across Victoria.

Australian Shelducks and Pacific Black Ducks in flight (Peter Menkhorst)

Pacific Black Duck (Peter Menkhorst)

Improving survey techniques for nocturnal wildlife

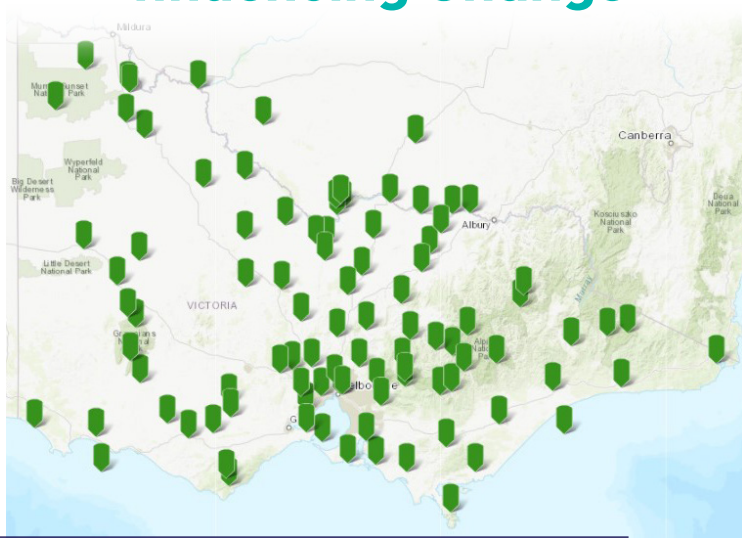
Nocturnal wildlife are some of Victoria's most charismatic and threatened species. Until recently, efforts to monitor many of these elusive creatures have relied on spotlight counts. These give an indication of animal abundance but cannot be expressed in terms of population size or density. An additional challenge for researchers is that not every animal is detected during a survey. If we were to take counts at face value, we would be underestimating their abundance which can have consequences for effective conservation management.

To address this challenge, a team of ARI researchers have developed and evaluated an improved method to estimate the abundance and density of the Southern Greater Glider (pictured). This **recently published research** shows that the double-observer method used in field spotlighting surveys gives a more accurate estimation of glider abundance. This improvement will lead to better informed management actions.

Greater Glider (Andy Geschke)

Spotlighting nocturnal wildlife (Andy Geschke)

Influencing Change



A new way to discover ARI science

ARI's Andrew Geschke has developed the ARI project map which can be used to discover the range of ARI projects and the breadth of expertise that ARI researchers offer. We encourage you to explore the interactive map which provides a short summary and link to each associated ARI project web page.

Feature publications

Gallagher, R.V., Allen, S., Mackenzie, B.D., Yates, C.J., Gosper, C.R., Keith, D.A., Merow, C., **White, M.D.**, Wenk, E., Maitner, B.S., He, K. (2021) High fire frequency and the impact of the 2019–2020 megafires on Australian plant diversity. Diversity and Distributions, 27: 1166-1179. https://doi.org/10.1111/ddi.13265

Rodger, Y.S., Pavlova, A., **Sinclair, S.**, Pickup, M., Sunnucks, P. (2021) Evolutionary history and genetic connectivity across highly fragmented populations of an endangered daisy. Heredity, 126: 846-858. https://doi.org/10.1038/s41437-021-00413-0

McNellie, M.J., Oliver, I., Ferrier, S., **Newell, G.**, Manion, G., **Griffioen, P.**, **White, M.**, Koen, T., Somerville, M., Gibbons, P. (2021) Extending vegetation site data and ensemble models to predict patterns of foliage cover and species richness for plant functional groups. Landscape Ecology, 36: 1391-1407. https://doi.org/10.1007/s10980-021-01221-x

Geary, W.L., Buchan, A., Allen, T., Attard, D., **Bruce, M.J.**, **Collins, L.**, Ecker, T.E., Fairman, T.A., **Hollings, T.**, Loeffler, E., Muscatello, A., Parkes, D., **Thompson, J.**, **White, M.**, Kelly, E. (2021) Responding to the biodiversity impacts of a megafire: A case study from south-eastern Australia's Black Summer. Diversity and Distributions (early online) https://doi.org/10.1111/ddi.13292

Knowledge transfer: some recent presentations and workshops

ARI seminars (subscribe here on the ARI website):

- **"Meet the Researcher: Maddi Miller on culture and country"** (Maddi Miller; Collaboration and Communication; University of Melbourne postdoc)
- **"Identifying frog calls with deep-learning AI"** (Peter Griffioen, Ecological Analysis and Synthesis Program)
- **"Bushfire recovery surveys for wildlife and flora"** (Tim O'Brien, Arn Tolsma, Jemma Cripps, Peter Menkhorst)
- **Sharing Stories of Nature Recovery forum** 'In search of Watson's Tree Frog in a post-fire landscape' (Louise Durkin, Threatened Fauna Program)

18th Australasian Vertebrate Pest Conference
'Is fox control as effective as we think? - Using an individual-based spatially-explicit population model to assess effectiveness' (Lachlan Francis, Ecological Analysis and Synthesis Program)

VEAC Science into management: Research on Victoria's public land
'Surveys for the Southern Greater Glider in the Strathbogie Ranges, north-east Victoria' (Jemma Cripps, Threatened Fauna Program)

Birdlife Australia – Floating Roost Workshop
'Roost selection by shorebirds in Western Port Phillip Bay' (Danny Rogers; Waterbirds and Wetlands Program)