Deriving decisions from data

An exciting and fast-changing aspect of our research involves developing new ways to synthesise and analyse data. Our staff, with skills in ecology, bioinformatics and software engineering, work together to create maps, tools and models that provide strategic insight and valuable support to decision-makina

Species distribution models - predict and map where suitable habitat occurs for a species. Among many applications of these models is identifying priority areas for nature conservation.

Population models – simulate the likely growth or decline of populations under different conditions. They help managers assess the conservation status of species and the potential outcomes of different management actions and scenarios.

Epidemiological models – help understand the transmission of disease in wildlife populations, and quide actions to control and eradicate disease.

Modelling environmental responses – predicts how plant and animal communities respond to land-use and environmental impacts, such as wildfire, timber harvesting, exotic predators, or changes in stream flows.

Mapping native vegetation - uses innovative techniques to model the extent and condition of native vegetation, and map where different types of vegetation occur.

Decision support tools - to determine optimum solutions for management. In this world-leading work, our staff bring together different kinds of information, (e.g. species maps, threats to species, the cost of management actions) to identify and map priority areas for management.

Some highlights from our legacy

For nearly five decades, since opening in 1970, the Arthur Rylah Institute has made many valuable contributions and discoveries for science and the Victorian community. These notable achievements and highlights include:

- the description of new species, such as the Long-footed Potoroo (in 1980) and 13 new species of galaxiid fishes (2014)
- establishment of the Victorian Biodiversity Atlas
- national leadership and partnerships with other states, such as for the Native Fish Strategy for the Murray-Darling Basin (2003–2013)
- leadership in developing new mapping approaches for vegetation type, extent and condition
- trialling and development of innovative techniques, including electrofishing, acoustic monitoring of fish movements, bat (harp) traps and automated bat detection, and remote camera traps.
- development of the world's first electrofishing boat for estuarine and saline waters
- major research programs evaluating the effects of timber harvesting and wildfire in forest ecosystems
- leading the establishment of the Land for Wildlife Program
- early work on the effects of DDT on falcons, contributing to the subsequent ban of DDT use in 1987
- new approaches to recovery of threatened species, such as 'fish rescues' after the 'Black Saturday' wildfire in 2009.

Staying at the cutting-edge

future and stay at the cutting edge.

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We recognise that ongoing investment and effort is required to remain at the forefront in this rapidly evolving world. Our scientists regularly seek opportunities to source new knowledge, and advance their capabilities through collaboration, skills development and training. An expansive program of invited and internal seminars creates an environment to hear, work with and seek feedback from the nation's best scientists. We ensure internal and external peer review of our publications, and our staff regularly contribute to expert professional associations and their conferences. Whole-of-institute, independent reviews, conducted by eminent biodiversity scientists, help us to plan strategically for the



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Science that matters!

Arthur Rylah Institute for **Environmental Research**





Science that matters!

"A unique institution." "The leading centre for applied biodiversity research in Victoria". "An astonishing range of specialist expertise".

These are common descriptions for the Arthur Rylah Institute for Environmental Research, part of the Biodiversity Division, Victorian Department of Environment, Land, Water & Planning (DELWP), and located in Heidelberg, Victoria.

ARI, as it is known, has a unique role in Victoria, and Australia. Collectively, our staff have an extraordinary breadth and depth of knowledge of the state's flora, fauna and ecosystems. We provide specialist advice to Governments and the community, we carry out research of national and international standing, and are active in the wider scientific sphere.

We share with you here, some of the distinctive elements that make ARI a special institution, especially the wide scope of its science, its innovative approaches and its partnerships in carrying out and communicating science that makes a difference; science that matters.



Prof. Andrew Bennett

Science Leadership and Capability, ARI

Joint appointment between ARI and La Trobe University o build science development and leadership

Our research: spotlight on threatened species, snags and fishways

Threatened species

For decades, ARI has studied Victoria's (often hidden) threatened species. These include both iconic and lesser-known animals, such as the Smoky Mouse, Long-footed Potoroo, Sooty Owl, Regent Honeyeater, Spotted Tree Frog, Alpine She-oak Skink, Hooded Scalyfoot, Macquarie Perch, Australian Grayling and many others.

Leadbeater's Possum, Victoria's faunal emblem and a globally endangered marsupial, is the focus of a major research program. Novel survey techniques (and including community records), sophisticated modelling and some creative habitat solutions are combining to provide knowledge essential for sustaining this threatened species in the face of competing land use.

Recovery of the endangered Trout Cod has involved a long-term, coordinated and multi-jurisdictional approach, in which ARI scientists have played a key role. Successful re-introductions to establish new populations have been underpinned by research into the breeding, movements and habitat of this species; and the development of a specialised population model to help assess management options.



What works?

Many of our projects test the effectiveness of management actions as part of an adaptive improvement approach. This requires careful study design, monitoring and analysis. We use manipulative experiments in some situations, such as the reintroduction of woody debris ('snags') into streams to test whether an increase in cover results in increased fish populations. We also use 'natural' experiments, such as when testing the impacts of different stock grazing treatments on native grasslands, or evaluating the effects of different fire histories on forest plants and animals.

The design and monitoring of 'fishways' to restore movements of native fish species, is an example of our scientists finding practical, effective solutions for management. To complete different stages of their life-history, fish must be able to move freely: upstream and downstream, and to and from wetlands and floodplains. In many situations, movement is restricted by dams, weirs and road crossings which reduce connectivity among habitats used for feeding and breeding. ARI has recognised expertise in designing fishways with specifications (e.g. water velocity, turbulence, light levels) that provide successful outcomes for fish.

Specialist expertise

Victoria has an enormous diversity of plants, animals and environments. At ARI, our scientists have a breadth of skills and knowledge to match and are actively involved in studying Victoria's ecosystems, from tall mountain forests and semi-arid Mallee, to alpine bogs and urban grasslands, freshwater streams, lakes and wetlands to coastal foreshores and estuaries. Our expertise ensures high-level scientific advice to Victorian Government Ministers, senior decision makers, and water and land managers. This advice guides decisions and management on critical biodiversity and conservation issues for Victoria. We are at the forefront of thinking around environmental flows, fire, emerging threats, and threatened species; and in developing new tools for a world which needs solid, data-rich decisions.

Sharing knowledge

Sharing research results is essential to advance scientific knowledge and to make a difference in conservation and management. We are passionate about sharing our work with other scientists, policy makers, managers, and the community. Our staff actively publish in national and international journals and are regularly invited to participate in scientific conferences. ARI's distinctive role, and a commitment to seeing our work applied, means that we also communicate in many other 'fit for purpose' ways to meet the specific needs of our clients, including technical reports, e-newsletters, fact sheets, social media, videos, training days and collaborative workshops.





The benefits of partnerships

Science is a collaborative process. We work creatively with many partners – locally, nationally, internationally. We work with decision makers and policy makers in all tiers of Victorian government, and in a suite of Commonwealth agencies. We work with water and land managers seeking solutions on the ground; and with communities, who share our commitment to making a difference.

Enhancing environmental flows

Delivering 'environmental flows' to improve waterway health involves multiple perspectives and multiple agencies. ARI has worked extensively with state and national agencies, such as the Victorian Environmental Water Holder, the Murray-Darling Basin Authority, catchment management authorities and river communities, to undertake research and monitoring to ensure the amount, timing and duration of flows deliver the greatest possible benefits from environmental water. Our research is regularly cited as the basis for significant policy and program decisions.

Long distance collaboration supports long distance bird migrations

Many shorebirds (e.g. sandpipers, plovers, knots) are long distance travellers. They spend summer in Victoria and migrate annually to the northern hemisphere to breed. Stopover sites along their migratory pathway, where they feed voraciously to 're-fuel', are critical for survival. Long-term, citizen science data from across Australia, show that many species are declining alarmingly. An international team, including ARI, has linked declines in Australia to the loss of critical stop-over sites, especially tidal mudflats of the Yellow Sea. Understanding the 'bigger picture', and international cooperation, will be essential to conserve these species.

Building skills and supporting the next generation of scientists

Novel techniques, specialist skills and new ideas are essential for delivering innovative science. We identify and deliver training needs for staff and recruit new staff with complementary skills.

We have strong partnerships with universities and many ARI staff supervise post-graduate research students. In just the last 3 years, for example, our scientists have co-supervised 17 PhD projects across eight universities in three states.

In 2016, as part of a growing partnership, ARI and La Trobe University jointly appointed two new Research Fellows to undertake cuttingedge research in landscape genetics, ecological modelling and fire ecology.