

The CERF-funded Taxonomy Research & Information Network (TRIN) addresses critical taxonomic knowledge gaps in key Australian animal and plant groups important for effective environmental management.

Beyond the current research in TRIN, which focuses on a small number of projects, the Network aims to catalyse collaboration of national taxonomy research projects assisted by modern information management and communications technology. Bringing together a critical mass of taxonomic activities will enhance and accelerate research and delivery of information on Australia's biodiversity, through:

- » Innovative approaches in the taxonomic process to capturing, assembling, analysing and managing information.
- » Providing freely accessible, appropriate, reliable, ready to use biodiversity information suited to the needs of users, enabling broad adoption and application of scientific knowledge.
- » Public awareness, training opportunities, growth of collaborative clusters and community engagement.

AUSTRALIAN ANTS

One aspect of our ant research aims to complete the first species-level revision of the Australian ant genus *Iridomyrmex*. This is one of the largest, most ecologically important, common and taxonomically challenging groups of Australian ants, occurring throughout Australia. Reliable identifications are difficult for many species; we are revising all species using a mix of morphology and molecular data.

Our results show that the total number of *Iridomyrmex* species is approximately 100, of which 37 species are new and will be formally described. A preliminary key to species is complete, illustrations are currently being finalised and a molecular phylogeny constructed.



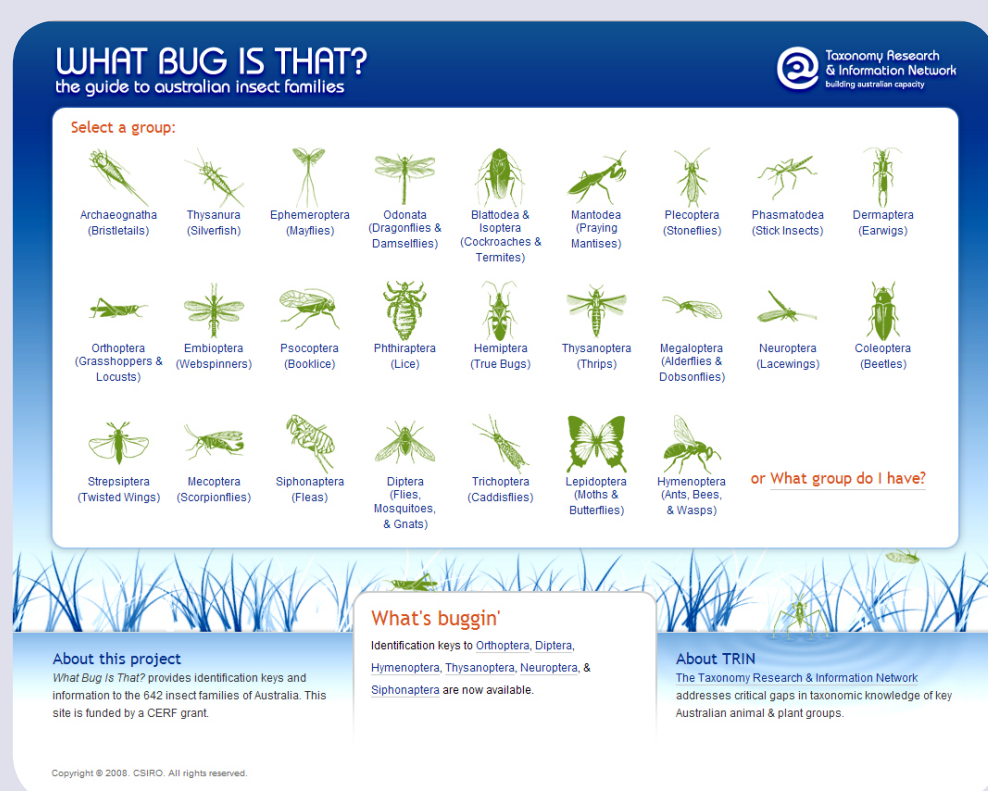
Iridomyrmex purpureus territorial display, near Bungendore, NSW

A field guide to *Iridomyrmex* species is being prepared as part of this project, in addition to the rigorous taxonomic treatment. This field guide will be electronically generated on demand using the most recently available information, ensuring that it is always up to date, and can be based on a specific region including only local species, simplifying the field guide and increasing its relevance for local users.

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INSECT FAMILY KEYS

This ambitious project will provide web-based keys for all 640 Australian insect families with a single portal and interface for identification. The initial phase focussed on development of keys to the 26 Australian insect orders. With nearly half the keys now complete, attention has turned to the design and development of the website hosting the keys, with the working title *What bug is that? The guide to Australian insect families*. Currently it is being integrated with the ANIC Biolink database and the draft site will be functioning by the end of 2008. Fact sheets are stored in Biolink and accessed via the Lucid key.



Development continues on the remaining keys, including editing information and sourcing images, for each family. A major source of images is from 2 professional insect photographers, Paul Zborowski and Jiri Lochman.

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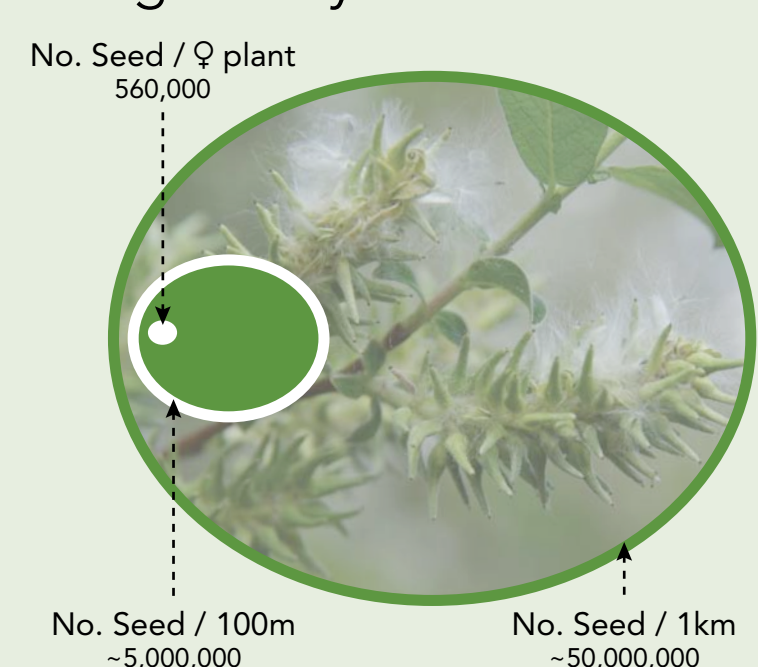
ENVIRONMENTAL WEEDS

Environmental weeds invade our bushland, placing pressure on native species and reducing biodiversity; lack of taxonomic knowledge affects the ability of managers to control them. Molecular systematics enables us to address fundamental questions, such as

- » Where in the world did weeds originate?
- » How much diversity is present in Australia and how is it distributed?
- » Where are the major sources for reinfestation?

This knowledge will improve on-ground weed control, and biocontrol agent discovery and deployment.

As a Weed of National Significance the highly invasive *Lantana* has been the subject of more than 100 years of low-efficacy biological control efforts. Through genetic and phenotypic profiling of weedy and native forms we are assembling a picture of the relationships among weedy varieties and how traits important for resistance to biocontrol agents are distributed among them.



Estimate of average *Salix cinerea* seed production. The total amount of willow seed produced at a location is dependent on level of infestation and sex ratio at the site; seed from a single female can be up to 850,000. Total seed produced at a single site of only 400m is estimated at over 26 million.

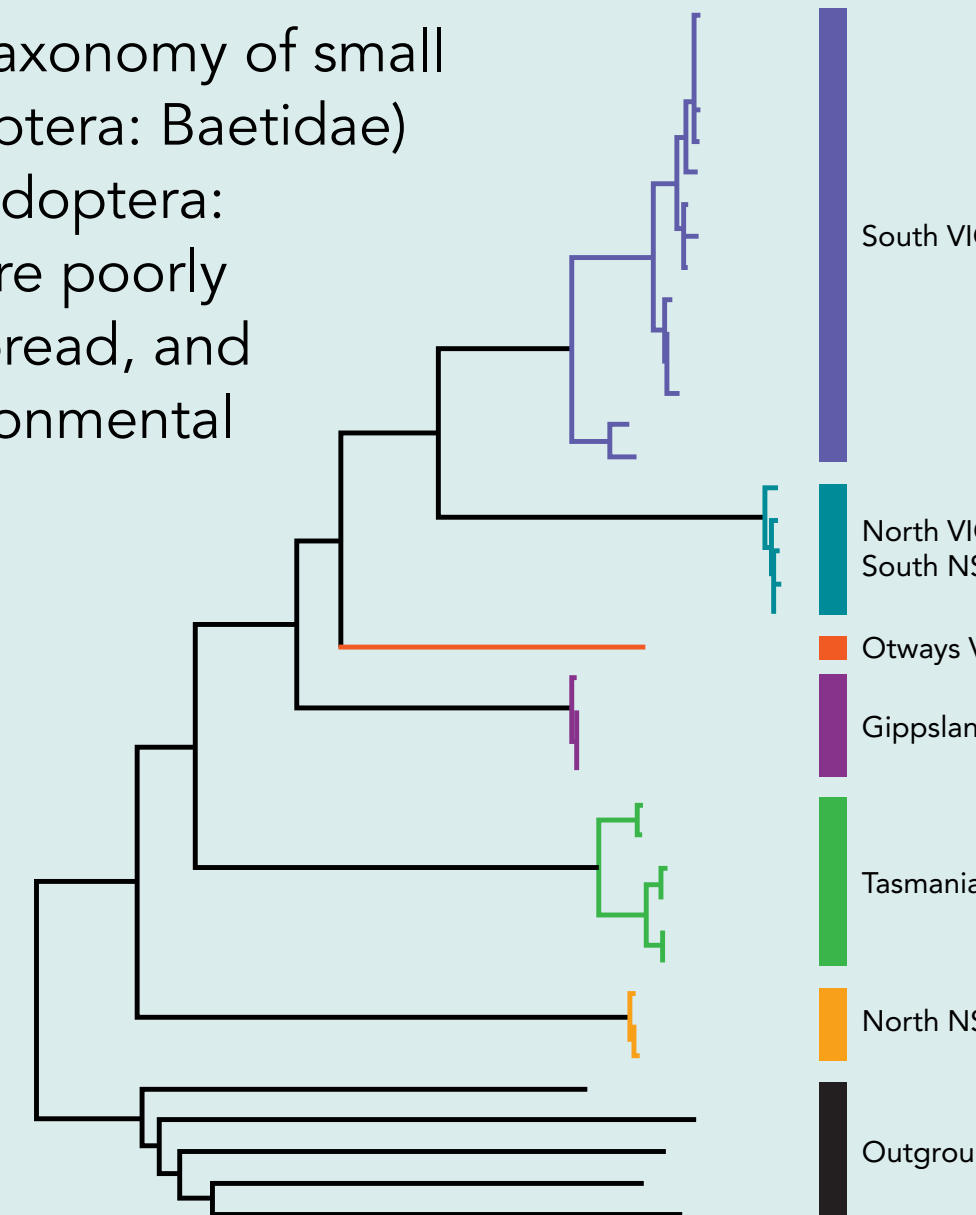
Willows are currently the subject of intensive traditional control methods. Our work is delineating species boundaries, population structure and gene flow parameters. Reinfestation of cleared sites may occur from as far as 50km away, highlighting the importance of knowing the location of major sources of reinfestation.

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AQUATIC MACROINVERTEBRATES

Aquatic macroinvertebrates are diverse and abundant throughout Australia and despite taxonomic knowledge of even the common groups being poor, they are widely used for monitoring the health of aquatic ecosystems.

This project focuses on the taxonomy of small minnow mayflies (Ephemeroptera: Baetidae) and aquatic caterpillars (Lepidoptera: Crambidae), both of which are poorly known yet abundant, widespread, and important indicators of environmental water quality. Smaller scale taxonomic projects focus on other mayfly families, and our taxonomic studies also incorporate various taxa of Trichoptera (caddisflies) through collaborations with EPA Victoria.



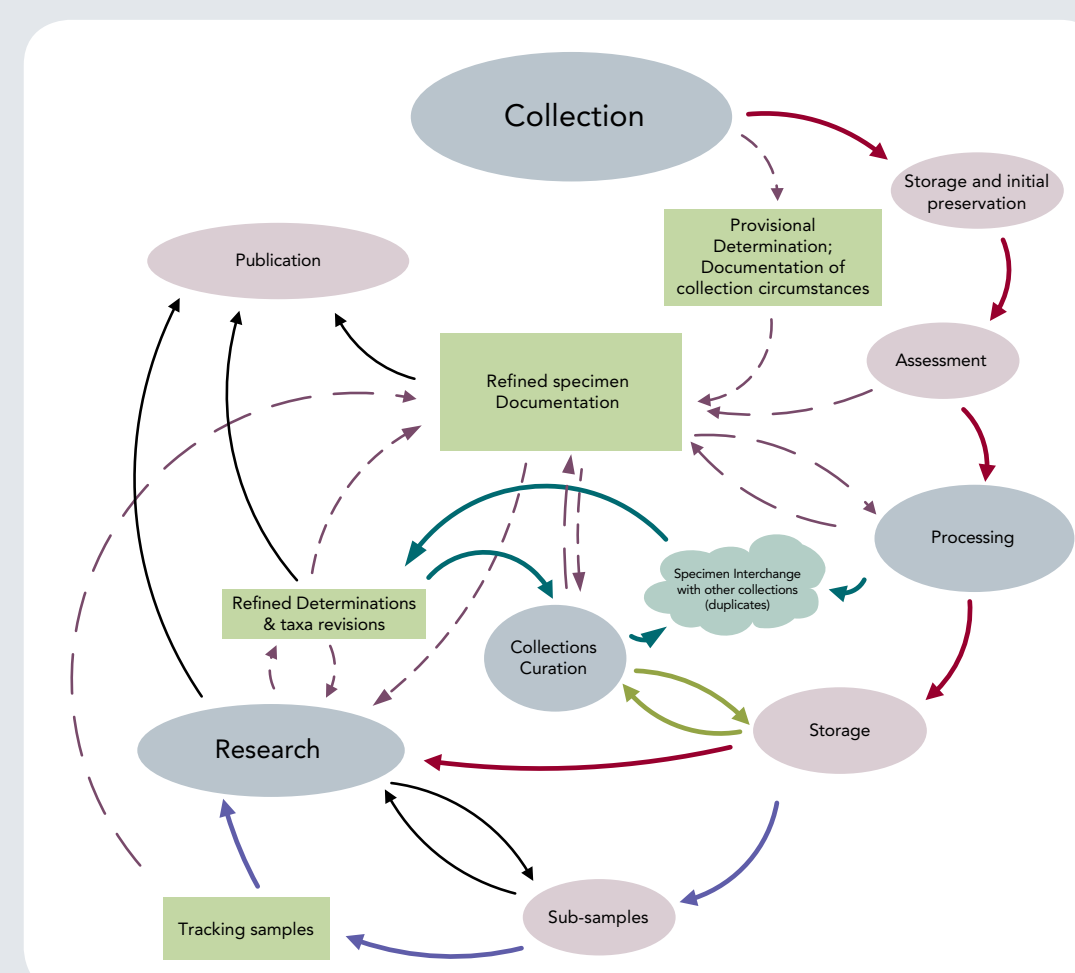
Relationships within *Edmundsiops hickmani* from eastern Australia - neighbour joining tree of 658bp section of COI.

A combination of morphological examination and sequencing of mitochondrial and nuclear DNA is contributing to species delimitation, discovery and description. The project has already recognized new species within the genera *Edmundsiops* and *Centroptilum* (Baetidae), including cryptic species within the current concept of *E. hickmani*.

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BIODIVERSITY INFORMATICS

To develop a clear understanding of the potential and actual constraints impeding stages of the taxonomic process, we are conducting a systematic investigation treating the entire process of taxonomy from specimen collection, through analyses, to publication, data delivery and beyond. This entails a rigorous systems analysis of the practice of taxonomy in an Australian context, using comparative analyses, interviews and structured workshops, to understand the complexity and diversity of modern taxonomy and promote the use and development of robust data standards.



To address the challenges of a sparse and dispersed pool of taxonomists, we are investigating contemporary internet information systems for enhanced collaboration.

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KNOWLEDGE EXCHANGE

A primary goal of TRIN is to ensure user communities are aware of and able to access and deploy results of the taxonomic research.

The Knowledge Exchange project, facilitated by knowledge brokers, is forming a responsive interface between individual TRIN taxonomic research projects and the specific needs of user communities by providing a framework for effective communications:



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- » ensuring a broad range of user communities are identified, scoped and considered
- » improving researcher understanding of user community needs and interests
- » eliciting user community needs and priorities, and impediments to adoption of research outputs
- » engaging user communities and researchers in collaborative development of taxonomic products
- » facilitating promotion, awareness and adoption of taxonomic results, outputs and products
- » involving user communities in evaluation and feedback on taxonomic products.

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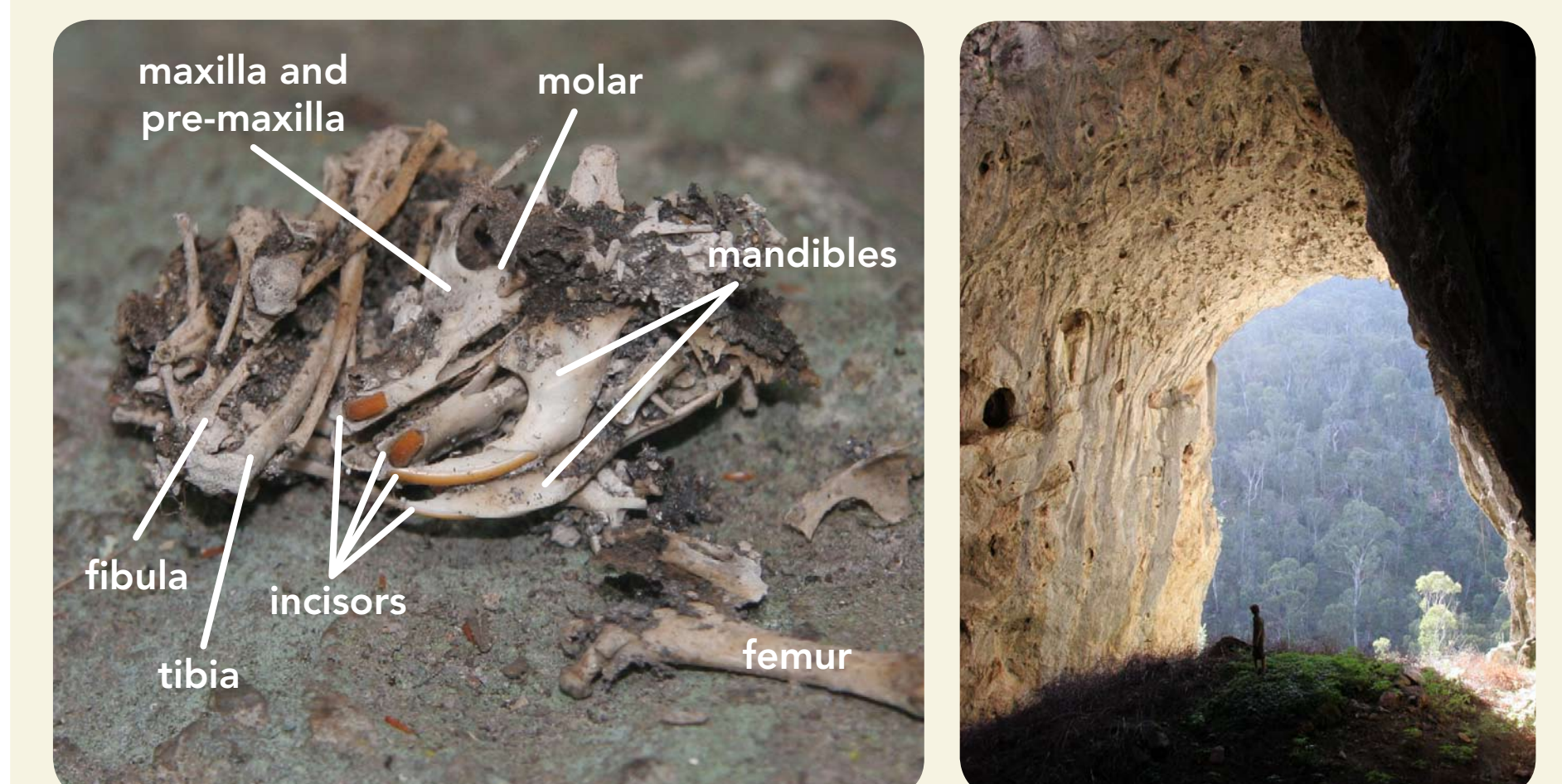
SMALL TERRESTRIAL VERTEBRATES

This project capitalises on Australia's new-found capacity to analyse DNA from long-dead animals. Coupled with genetic and morphological analysis of modern populations of small mammals and reptiles, we are building a picture of where and why Australia's species diversity occurred, and how we can best manage what remains through the challenges of climate and habitat change. Provision of an accurate list of species that occurred in the Canberra region 200 years ago, facilitates the choice of species for a re-introduction program.

These results benefit from our ability to identify bones from cave deposits of owls' prey remains, and to match extinct populations to their nearest living genetic match. This ensures the best replication of the natural system, maintenance of natural patterns of genetic structure, and the best chance of successful re-colonisation.

Ecological profiles of locally extinct species across south-eastern NSW based on natural distributions provide a powerful predictive tool for understanding the impacts of climate change on remaining populations.

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Left: Remains of a bush rat *Rattus fuscipes* in a sooty owl pellet. Right: Cave floors preserve a unique record of our lost fauna - brought into the cave by owls roosting on the walls above

MANGROVES AUSTRALIA

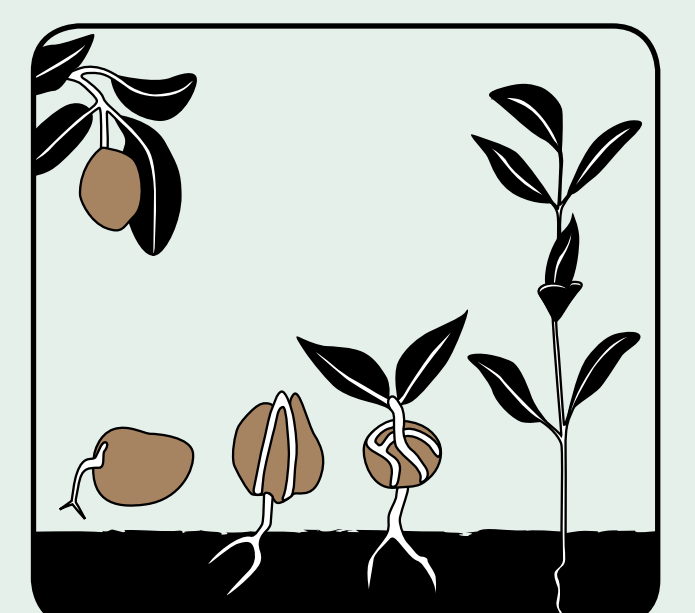
This national-scale, multi-agency collaborative activity aims to create information on mangrove species for projects such as the *Atlas of Living Australia* and to underpin government policies and programs, scientific research and public education.

It builds on existing biodiversity information management activities, resources and expertise around the nation and beyond. Information on the plant and animal species found in Australian mangroves is being collated, with emphasis on taxonomy, appearance, identification, biology, distribution and ecology.

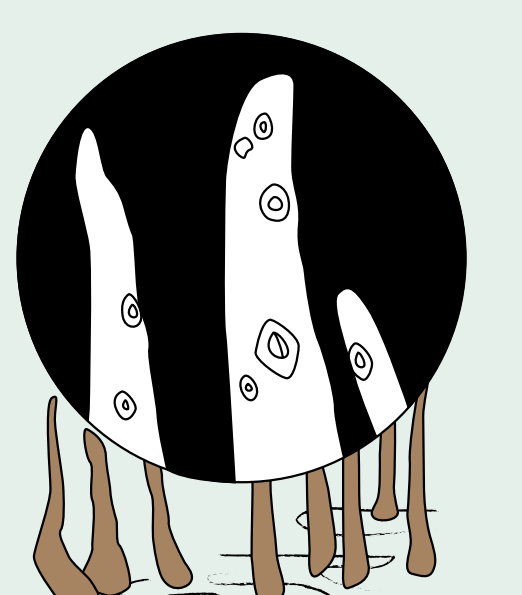
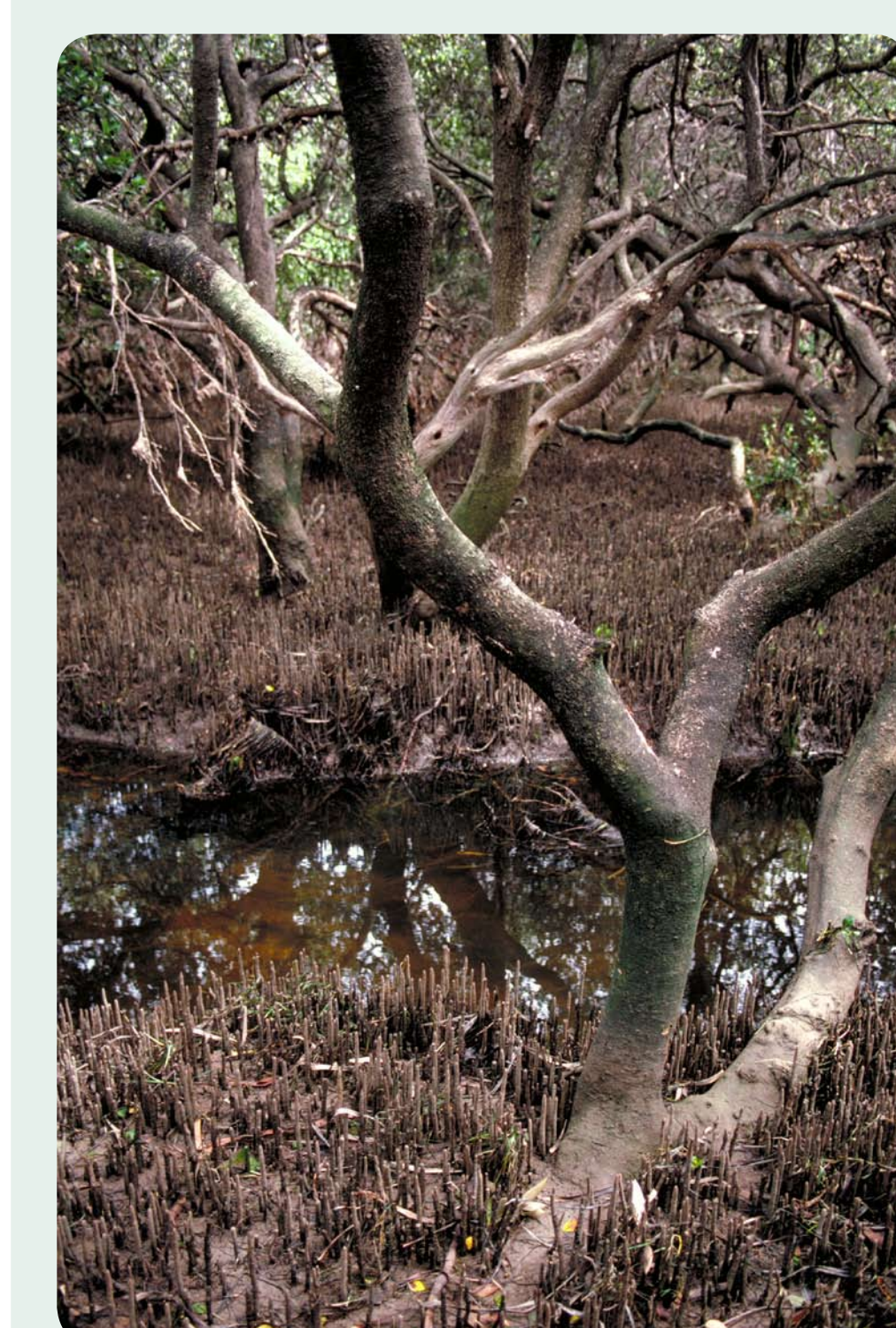
The project will focus on developing active and inclusive partnerships to provide freely available on-line access to information using current biodiversity information management technologies.

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The harsh physical conditions found in mangrove habitats have resulted in a relatively high degree of specialisation amongst mangrove plants. *Avicennia marina* (Grey Mangrove) possesses some typical mangrove adaptations:



Seeds germinate while still attached to the parent plant (cryptovivipary). Propagules float on water and quickly take root in unstable and frequently flooded substrates.



Air-breathing roots (pneumatophores) allow gas exchange in saturated soils.