OCTOBER 2024 — VICTORIA'S ECOSYSTEMS

SCIENCE VICTORIA

Nature Positive

Regenerating and Repairing the Environment
— pg 14

Moss Effect

Bryophytes in Victoria's Ecosystems
— pg 16

When the Cat's Away

Addressing Feral Cats
— pg 20

Inside

ISSN 2981-8664
09
9 772981 866005

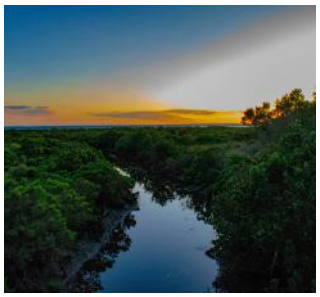
Warburton, Victoria.
Photograph: Zac Porter via Unsplash.

In This Issue

VICTORIA'S ECOSYSTEMS

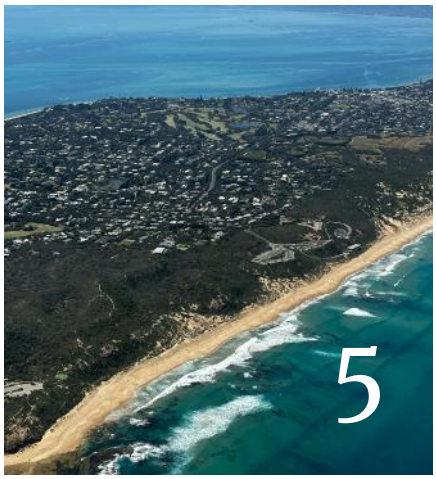
Victoria is home to a diverse range of environments, which vary based on factors like local climate, water availability, elevation, geology, geomorphology, soils, and others.

In turn, these environments are home to different ecosystems, comprising all manner of life that have lived in these niches for centuries. This month, we take a look at some of these different ecosystems, and how we might value and protect them.



ON THE COVER

Tankerton Creek, French Island, Victoria. Photograph: Owen Pawsey via Unsplash.



Upcoming Submission Deadlines

For all 2024 editions and deadlines, refer to page 45.

NOVEMBER 2024	**DUE DATE**
Science & Policy	*5pm, 18 October*
DECEMBER 2024	**DUE DATE**
Science & Business	*5pm, 15 November*

From the Editor

SCOTT REDDIEX
Editor-in-Chief — Science Victoria

The different parts of Melbourne all have a unique identity. Different infrastructure, a different industrial/commercial/residential history, and different migrant communities at different times.

Inner city suburbs that were once slums are now gentrified almost beyond recognition. Even the clothing differs – the 'Collins St., 5 pm'[1] look of CBD office workers, the kaleidoscope of colours of Fitzroy, the fluoro workwear in the pop-up estates of the west and outer south-east, and the different school and sporting uniforms throughout.

And "Victoria" isn't Melbourne. The cares, concerns, culture, and cuisine of Geelong, Horsham, Wodonga, Sale, Portland, and Shepparton are all different from Melbourne and from each other.

The point is, nothing about this region we've labelled "Victoria" is truly homogeneous from a human perspective, let alone any other. The life that exists along coastal areas varies between the bays, estuaries, headlands, and beaches. The plants and animals that exist close to rivers and lakes are different to those in the drier parts of west/north-west Victoria. High-country differs from floodplains, colder varies from warmer. The life of a person, plant, or animal in Mildura is different to one in Port Albert.

One way of viewing the different environments found in Victoria is by dividing them into 28 different 'bioregions'.[2] This approach classifies environments based on different factors like climate, geomorphology, geology, soils, and vegetation. And yet, within each of these bioregions, you will find myriad ecosystems – many overlapping with each other – as all of the different lifeforms exist harmoniously within a particular niche.

There are so many different ecosystems that exist in our state. It is worth noting that they evolved with First Peoples for >30,000 years, in a more symbiotic relationship than the generally destructive/exploitative one that has existed since the arrival of Europeans.

This month in *Science Victoria*, we take a look at some of the different ecosystems in our corner of the world. Gordon Noble examines how we can move from being 'nature exploitative' to 'nature positive'. Dr Matt Dell and Dr Josephine Milne introduce us to bryophytes, which include plants like mosses, liverworts, and hornworts. Reade Barnett explores what makes Australia's birds unique, and Lisette Mill shares her practical experience in managing feral cats.

Elsewhere in this edition, you can read about the inquiry into the 2022 Victorian floods, a summary of major events from this year's National Science Week, and get an update on Zoos Victoria's Moth Tracker.

We hope you enjoy this edition of *Science Victoria*.

REFERENCES: 1. Brack, J. (1955). Collins St, 5p.m. [Oil on canvas]. National Gallery of Victoria (NGV), Melbourne, Victoria, Australia. ngv.vic.gov.au/explore/collection/work/3161

2. DEECA. (2019). Bioregions and EVC benchmarks. Environment. www.environment.vic.gov.au/biodiversity/bioregions-and-evc-benchmarks

SCIENCE VICTORIA

VOLUME 4, NUMBER 9, OCTOBER 2024

The Monthly Publication of the Royal Society Victoria - Established 1854 for the promotion and advancement of science. Supported by the *Inspiring Victoria* Program.

The Royal Society of Victoria
8 La Trobe Street, Melbourne, VIC 3000
+61 3 9663 5259

RSV.ORG.AU/SCIENCE-VICTORIA

Editorial

EDITOR-IN-CHIEF Scott Reddiex
SENIOR EDITOR Dr Catriona Nguyen-Robertson
DESIGN Rosie Everett, Brand Warrior

Contributors

Dr Catriona Nguyen-Robertson, Mr Scott Reddiex, Mr Gordon Noble, Dr Matt Dell, Dr Josephine Milne, Ms Lisette Mill, Ms Reade Barnett, Ms Lucy Hayward, Ms Nyuk Mei Liu, Mr Ryan Harper, Mr Adeel Siddiqi, Mr Ben Kimber, Dr Marissa L. Parrott

Letters to the Editor

editor@sciencevictoria.org.au
Letters may be edited for length and clarity

Advertising Enquiries

rsv.org.au/advertise-with-scivic

The RSV

PRESIDENT Mr Robert Gell AM
VICE PRESIDENT Prof Caroline McMillen AO
HON. SECRETARY Mr Jeffrey Luckins
HON. TREASURER Mr Siddharth Verma
CEO Mr Mike Flattley

Membership and Commercial

James McArthur
james.mcarthur@rsv.org.au

Partnerships and Events

Mike Flattley
ceo@rsv.org.au

Find Us Online

rsv.org.au
twitter.com/RoyalSocietyVic
youtube.com/@RoyalSocietyVic
facebook.com/RoyalSocietyVictoria
instagram.com/RoyalSocietyVic
linkedin.com/company/The-Royal-Society-of-Victoria

Acknowledgement of Country

The Royal Society of Victoria acknowledges our headquarters are located on Wurundjeri land, never ceded, and convey our respect to Elders past and present. The RSV welcomes all First Peoples, and seeks to support and celebrate their continued contributions to scientific knowledge.

Subscribe to receive *Science Victoria* online at **eepurl.com/bg-fjH**

From 'Bouncy Pork' to Ecocide

George, a Leadbeater's Possum (*Gymnobelideus leadbeateri*), and a representative of Victoria's faunal emblem species. Photograph: John Englart via flickr (CC BY-SA 2.0).

ROB GELL
President, The Royal Society of Victoria

'Who is Moo Deng?' the ABC's online news service asks.[1] It seems moo deng translates to 'bouncy pork' in the Thai language. It's a Thai dish, and also the name given to a baby pygmy hippopotamus (*Choeropsis liberiensis*).

The species is native to the swamps of west Africa where it is reclusive, nocturnal and endangered. Moo Deng is in a Thai zoo and has become a social media phenomenon, attracting very large crowds. Her siblings are also named for varieties of pork dishes.

It would be comforting to think that Moo Deng's visitors were concerned about pygmy hippo habitats in Liberia and the status of her species and not visiting her entirely for their amusement or to see how to wear their makeup in her pink and peach tones, as one cosmetics chain has suggested.

I often find myself correcting people who reference 'the' environment, explaining that it's 'our' environment; our species is a critical component of our global ecosystem – we're not separate from it. We don't live outside of nature and nature is not there for us to endlessly exploit.

In any assessment of Victorian ecosystems – the theme for this month's edition of *Science Victoria* – it's important to reinforce their uniqueness. It's more than 30 million years since this continent separated and began moving northward away from Antarctica in the Eocene. Australia's terrestrial ecosystems have been evolving in isolation from the rest of the globe's major landmasses, with the result of this landmass holding a remarkable number of endemic species – both plants and animals – found here, and nowhere else.

As a result, our continent is megadiverse. With only a few other countries, Australia harbours an exceptionally high level of biodiversity. In parallel, particularly as a developed nation, we also have an exceptionally high level of responsibility to conserve our unique ecosystems and the lifeforms they support.

In Victoria, there has also been at least 30,000 years of landscape and species adaptation to the sustainable activities of First Peoples. Before the arrival of Europeans, 88% of Victoria was covered in forests and woodlands. Large-scale land clearing for agriculture, grazing, timber production, and urban expansion has reduced that to about 35-40% of its original extent. With only a moderate level of confidence, Victoria's *State of the Environment 2023 Report* records that fragmentation of native forest cover continues, and its status is 'poor', with a deteriorating trend.[2]

There are few wins. This is reflected in the level of excitement we enjoy when we learn that the eastern barred bandicoot's status is no longer 'extinct in the wild' – it's merely endangered. Our state's faunal emblem, Leadbeater's Possum (*Gymnobelideus leadbeateri*), finally has a new recovery plan, while populations of critical keystone species such as the Bogong Moth (*Agrotis infusa*) have collapsed by an estimated 99.5%, leaving them and the critically endangered Mountain Pygmy-possums (*Burramys parvus*) at great risk.[3,4]

The Victorian Government is 'investing' $32 million to reduce the impact of invasive species, thereby improving the resilience of indigenous species. Unfortunately, this is utterly insufficient for conducting the interventions required at the habitat scale to halt and reverse the established trends. When challenged, our political leadership either provides economic excuses for continued underfunding for the recovery of nature, or prioritises the damaging economic status quo at the expense of further ecosystem losses.

Our Environment Ministers need to become champions for our environment, not economic apologists. They are

able to provide these excuses because the majority of the Australian population appears to be either totally dissociated from nature, or under the misapprehension that the natural world will be continually available for our use and that a photo-opportunity with a koala will somehow be sufficient to demonstrate a commitment to conservation.

> Native plants and animals have an intrinsic right to exist, thrive and flourish. Threatened species and communities contribute to the vast range of biodiversity benefits we depend on and we, as Victorians, have a duty to protect them.[5]

Imagine if we had State and Federal environment ministers with the level of understanding that retiring Minister for the National Disability Insurance Scheme (NDIS) Bill Shorten has for his portfolio. Leaders openly explaining that our economic system is a wholly-owned subsidiary of our environment, discussing the need for substantial reinvestment in nature, protection of critical ecosystems and the myriad species that comprise them, not just the photogenic ones.

However, it seems that many people across the world, including 68% of Australians, believe that not enough is being done and indeed are in favour of ecocide laws. The Global Commons Survey 2024, conducted by Ipsos UK and commissioned by Earth4All and the Global Commons Alliance (GCA), found that of 22,000 participants aged 18-75 across eighteen G20 countries – excluding Russia but including Austria, Denmark, Kenya, and Sweden – 72% support making it a criminal offence for our leaders to approve actions that cause serious environmental damage.[6]

There is considerable need for the Royal Society of Victoria as an organisation, our membership as a support base, and all stakeholders in a sustainable future to take up the challenge in our daily conversations and become strong advocates, recognising that significantly more needs to be done to stabilise the loss of our critical, unique ecosystems.

If not now, then when?

REFERENCES:

1. Dervisevic, H. (2024, September 15). Who is Moo Deng? The viral pygmy baby hippo who's amassed a legion of fans across social media. ABC News. abc.net.au/news/2024-09-15/moo-deng-baby-pygmy-hippo-thailand-zoo/104353256
2. State of the Environment 2023 Report. (2023). CES. www.ces.vic.gov.au/soe2023
3. National recovery plan for Leadbeater's possum (Gymnobelideus leadbeateri). (2024, March 4). DCCEEW. www.dcceew.gov.au/environment/biodiversity/threatened/publications/recovery/leadbeaters-possum-2024
4. Parrot, M. L., Van Hoeydonck, E., & Sly, H. (2024, July 4). Moth Tracker. Science Victoria, 4(6). rsv.org.au/moth-tracker
5. Threatened species overview. (2020, July 10). DEECA. www.environment.vic.gov.au/conserving-threatened-species/threatened-species-overview
6. Heath, V. (2024, September 6). 72% of G20 citizens support criminalising environmental damage. Geographical. geographical.co.uk/news/72-of-g20-citizens-support-criminalising-environmental-damage

Climate Change Impacts on the Mornington Peninsula

GEOGRAPHY VICTORIA *with* **JENNIFER FRASER**

It was a momentous day for Geography Victoria – our first field trip beyond the Melbourne metropolitan area!

National Science Week and a grant from the *Inspiring Victoria* program provided Geography Victoria with the opportunity to explore the dynamic nature of Mornington Peninsula's coastal and marine environments. The focus of the excursion for our twenty-five participants was the impacts of climate change and effective adaptation and mitigation strategies to protect our coastal environment.

Participants learned from two expert presenters: Dr James Driscoll, Director of STEM Outreach and geologist (School of Earth Atmosphere, & Environment, Monash University), and coastal geomorphologist Rob Gell AM. Hands-on practical activities further enhanced the experience.

Jennifer Fraser, one of the participants, noted:

"Did you know that the grains of sand on a beach usually correspond in size to the slope or steepness of the shore? The steeper the slope, the coarser the sand. This is just one snippet of so many that I learned as we explored on the beaches of the Mornington Peninsula.

Members of the group visited beaches at McCrae, Blairgowrie, Portsea and the back beach at Sorrento and at each place considered the wind, the waves and the longshore drift. We looked at areas of erosion and places of deposition, the levels of management evident in each location, and discussed the effectiveness of the various mitigation methods used around peninsula beaches. We sketched and measured and even threw oranges into the bay to explore concepts that were new to many of us.

The information and discussions of the presenters were supported by a terrific set of notes and ably assisted by home-made muffins and a gloriously sunny day that promised spring would soon be here.

Portsea, Victoria. Photograph: Haydn Pound via Unsplash.

And did the beaches demonstrate the general rule? The relationship was true for Blairgowrie and Sorrento but not for McCrae. And why? Significant beach renourishment in 2020 pumped sand across the foreshore to restore its width and support its recreational uses, and so interrupted the relationship between grain size and beach shape."

It was indeed fortuitous that one of the field trip participants was a planner with the Mornington Shire Council. During the lunch break, he shared his insights into the types of coastal and beach management strategies that have been employed in the area to mitigate the impact of climate change. As a first experience by Geography Victoria beyond the metropolitan area, the day was a great success, and we look forward to being able to venture further into the future.

You can visit Geography Victoria's new website at **geogvic.org.au**, where you can find all of our upcoming events at **geogvic.org.au/events**.

Geography Awareness Week will run from the 11th to the 15th of November. The formal launch of Geography Victoria will be held next month on the 10th of November, at a gala event at the Melbourne Town Hall. We hope to see you there!

Image courtesy of Scientell

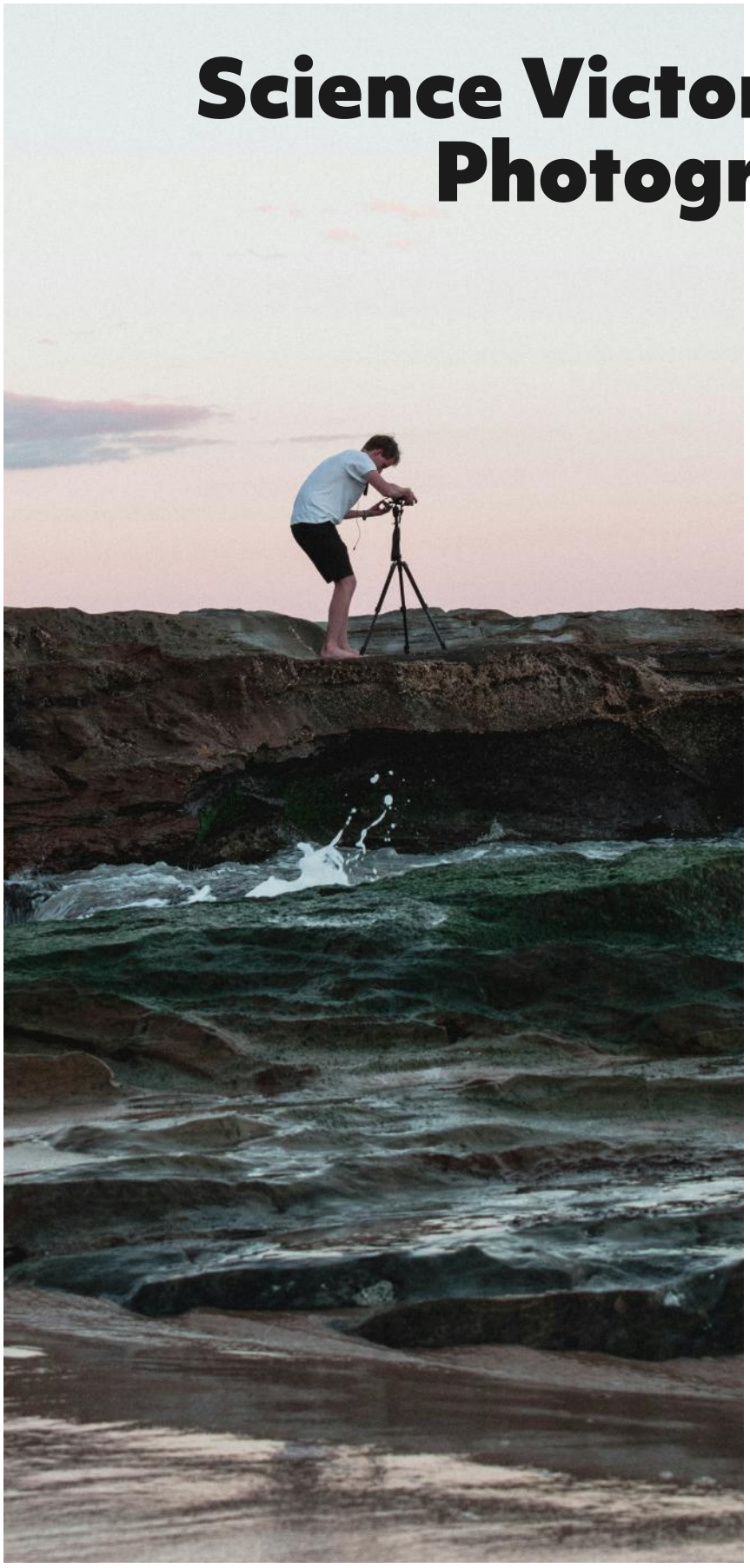
Vale Paul Holper (1957 - 2024)

This month the RSV mourns the sudden passing of our friend and colleague Paul Holper, one half of the dynamic Scientell leadership duo with Dr Simon Torok.

Paul had earlier worked for CSIRO in the field of environmental research for over 25 years in senior communication and research management roles. He managed the Australian Climate Change Science Program, was convenor of the high-profile Australian climate change science "Greenhouse" conference series, and was Communication Manager for Atmospheric Research.

With Simon and his Scientell colleagues, Paul has convened many forums and authored and edited numerous books and reports, translating complex scientific intelligence into clear, useful guidance to inform education and robust, evidence-based decision making. With an Honours degree in chemistry and qualifications in science communication and education, Paul's playful and generous nature has been a valued feature of Australia's science communication community for decades and his loss is keenly felt by colleagues from many walks of life.

Family and friends remembered Paul at an inspiring memorial service at the Royal Society of Victoria on Friday, 20 September, 2024; the livestream recording is available to view from **vividstream.com.au/live/paul-holper.**



Photograph: Karl Hedin via Unsplash.

Science Victoria STEMM Photography Prize

Win $300 and celebrate the world of STEMM.

We are excited to announce the first annual *Science Victoria* Photography Prize!

In 2023, we introduced the 'Snapshots of STEMM' section to our magazine, as a way to connect the images of everyday science with a general audience.

This year, the images published each month will form a shortlist, from which a winner will be selected at the end of the year.

Applications for the 2024 round are open until 15 November (the deadline for the December edition), and a winner announced in the February 2025 edition of *Science Victoria*.

The winner will receive a $300 prize, and a certificate.

Images must be original photographs that capture your day-to-day work in STEMM. These are not stock photos or overly posed images. Instead, they show what working and studying in a STEMM field is actually like.

PRIZE:
$300 prize, and a certificate.

RESOLUTION:
All photographs must be of sufficient size and quality for printing – as a rough guide, aim for >1.3 MB in file size.

SUBMISSIONS:
Submissions can be made until 15 November 2024 by emailing **editor@ScienceVictoria.org.au.**

ENQUIRIES:
For any questions about submissions for the *Science Victoria* STEMM Photography Prize, please contact **editor@ScienceVictoria.org.au.**

Dr Richard Marchant collecting aquatic invertebrates at Grey River Picnic Area in the Otways.
Photograph: Rodney Start/Museums Victoria.

Science Adventure: Hands-On Discovery Day at Yarraville Community Centre during National Science Week. Children learned how water travels through plants by watching coloured water travel between glasses via the plant stems. Photograph: Yarraville Community Centre.

Mark Mierner via Unsplash

Enabling the Distributed Energy Resources (DER) Revolution

From dynamic pricing to virtual power plants, energy communities, and microgrids. Presented by Professor Pierluigi Mancarella, Melbourne Energy Institute's (MEI) Energy Systems Program Leader.

This lecture will present fundamental techno-economic aspects of key approaches that could enable large-scale deployment of DERs and CERs – from dynamic pricing to virtual power plants, energy communities, and microgrids – and discuss the benefits of demand side integration into systems and markets. Several case studies from recent projects in Australia and internationally will be used to exemplify the concepts presented.

DATE/TIME:
Tuesday 8 October 2024, 3pm - 4pm

PRICE:
Free

LOCATION:
Melbourne Connect,
700 Swanston Street,
Carlton, VIC 3053

BOOKING LINK:
events.unimelb.edu.au/event/38465-enabling-the-der-revolution-from-dynamic-pricing-to-vi

Denise Jans via Unsplash

Transforming Infrastructure and the Built Environment

Join us for the official launch of the RMIT Post-Carbon Infrastructure and the Built Environment Research Centre.

The Post-Carbon Research Centre was established to tackle complex challenges of decarbonising the built environment and infrastructures to transition to a sustainable, equitable and resilient future.

This event will bring together industry leaders across the fields of architecture, engineering, construction, infrastructure and sustainable development for a series of discussions and presentations.

DATE/TIME:
Wednesday 16 October 2024, 4pm - 6pm

PRICE:
Free

LOCATION:
Kaleide Theatre, Building 8,
RMIT University
360 Swanston Street,
Melbourne, VIC 3000

BOOKING LINK:
rmit.edu.au/events/2024/october/transforming-infrastructure-and-the-built-environment

Comparefibre via Unsplash

Learning Design and Technology: Transforming educational experiences

Hosted by the School of Curriculum, Teaching, and Inclusive Education, our event promises to reshape how we think about learning design and technology in education. Join leading experts as they explore cutting-edge digital technologies that promote equity and inclusion, from balancing tech in learning to AI-driven soft skill simulations. Our panel will also present on trauma-informed virtual learning strategies and innovative approaches to using generative AI in assessments.

A must for forward-thinking educators eager to embrace new technologies and enhance equity and inclusion.

DATE/TIME:
Wednesday 16 October 2024, 5pm - 7pm

PRICE:
Free

LOCATION:
Monash University Clayton Campus
19 Ancora Imparo Way,
Clayton, VIC 3800
(Simulcast online)

BOOKING LINK:
monash.edu/news/events/learning-design-and-technology-transforming-educational-experiences

Par Whelen via Unsplash

Rethinking an Urban Era | Melbourne Centre for Cities Symposium

The Melbourne Centre for Cities' annual symposium, themed "Rethinking an Urban Era," explores the optimistic narrative surrounding our complex urban spaces.

We are shifting away from the belief that growth is inherently negative and are adopting a mindset focused on climate resilience. This approach centres on multilayered, holistic governance; and sustainability for humans, non humans and the environment they both rely on.

While pursuing these positive changes, we must also address the pressing need to tackle inequality in decision-making and outcomes within our cities.

DATE/TIME:
Thursday 24 October 2024, 9am - 4pm

PRICE:
Free

LOCATION:
Old Quadrangle Building (Building 150)
The University of Melbourne,
Parkville, VIC 3052

BOOKING LINK:
events.unimelb.edu.au/event/40868-rethinking-an-urban-era-melbourne-centre-for

2023 Young Scientist Research Prizes Finalists. Photograph: Karey Shandler/Verse Photography.

Young Scientist Research Prizes

To foster and recognise excellence in Victoria's early career scientists, the Royal Society of Victoria has established four prestigious competitive prizes open to Victorian students in their final year of doctoral candidature, in all areas of the Biomedical & Health Sciences, Biological Sciences (Non-human), Earth Sciences and Physical Sciences.

Following assessment of applications across the four categories, we have selected eight PhD finalists to present years of research work to us in ten short minutes. Join us at the Royal Society of Victoria's historic Hall in the Melbourne CBD to hear about the latest science from our emerging scientists, and to support and celebrate the achievements of Victoria's upcoming high achievers.

DATE/TIME:
Thursday 24 October 2024, 6pm - 9pm

PRICE:
Free

LOCATION:
The Royal Society of Victoria
Wurundjeri Country
8 La Trobe Street
Melbourne, VIC 3000

BOOKING LINK:
rsv.org.au/events/ysrp-2024

In 2024, we welcome the Australian Radiation Protection and Nuclear Safety Agency as the category sponsor for the Physical Sciences, and the supporting sponsorship of Geoscience Australia to foster emerging talent in the Earth Sciences. Now a part of the Inspiring Victoria program, the Society is grateful for the generosity of our members, past and present, in supporting these prizes since 2012.

Australian Government
Australian Radiation Protection and Nuclear Safety Agency

arpansa

Image: Museums Victoria

Starlight and Stories of the Stars: Dr Cat's Homeward Bound Fundraiser

Science communicator Dr Catriona Nguyen-Robertson needs your help to get to Antarctica. In return, she'll show you the stars!

Dr Cat has been selected to participate in the Homeward Bound voyage to Antarctica, which aims to boost the leadership skills, visibility, and impact of women and non-binary people in STEMM.

Join Dr Cat in Melbourne Planetarium for the film Starlight, which features stunning fulldome visualisations of being inside a supernova explosion and drifting through a stellar nursery, a rich gaseous nebula that is collapsing into stars. This will be followed by a guided tour of the night sky above Melbourne and a trip through the cosmos.

DATE/TIME:
Saturday 26 October 2024, 4:30pm - 5:30pm

PRICE:
$15 (concession)/$20 (full)

LOCATION:
Melbourne Planetarium,
Scienceworks
2 Booker Street,
Spotswood, VIC 3015

BOOKING LINK:
events.humanitix.com/starlight-and-stories-of-the-stars

RSV Events

The RSV hosts many STEMM-related events, public lectures, and meetings throughout the year. These are held at the RSV Building at 8 La Trobe St, Melbourne (unless otherwise indicated), and simulcast online. Our public lectures comprise the "Scientists in Focus" component of the Inspiring Victoria program in 2024.

Missed an RSV event?

You can catch-up on presentations from world-leading minds at **youtube.com/@RoyalSocietyVic**

Don't have time to watch a full presentation? Try one of the summary videos to catch the highlights.

youtu.be/7Mg0KHon6RU
Science, Media and the Law: Lessons from the Kathleen Folbigg Case

youtu.be/tMJN6RixaUE
Australian Drylands Rivers: Alive and Kicking

youtu.be/JL6SiKT9jSI
Aiming Higher: Improving Science Education in Victorian Schools

youtu.be/_cWif2yGmH0
Space To The Rescue: Australia's Dependencies on Space Technology

youtu.be/CDE446enrt0
Holocene Climatic Fluctuations in the Australian Region

youtu.be/OdSsdcSUO0o
Reimagining Humanity in the Age of Generative AI

Awards & Prizes

National Science Week 2025 Grants

APPLICATIONS CLOSE *25 October 2024*

National Science Week 2025 grants are now open!

Up to $20,000 is available for individuals and organisations interested in creating science engagement activities for National Science Week 2025.

Activities can include:

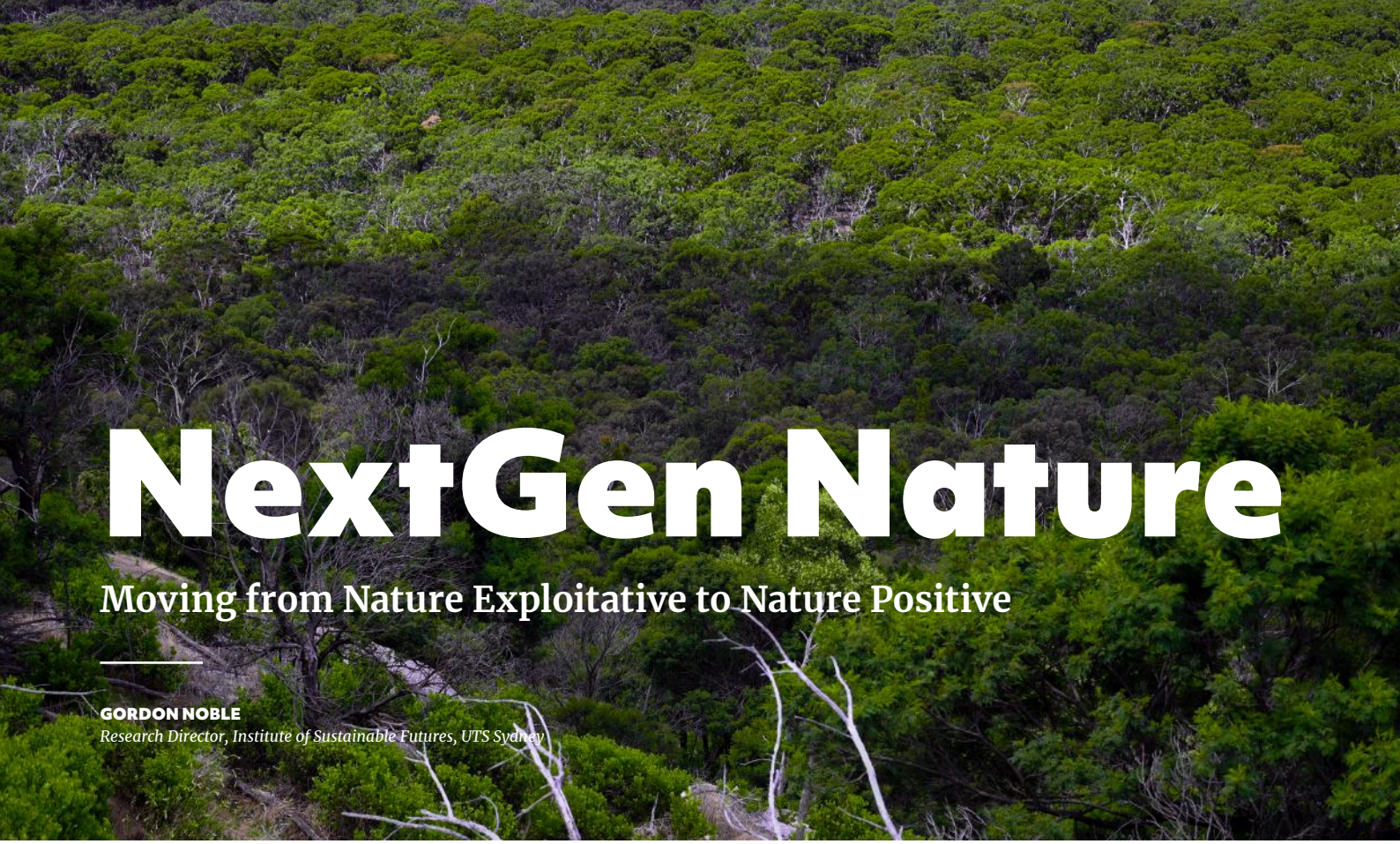
- in-person activities such as workshops, fairs and theatre
- online activities with two-way audience participation
- do-it-yourself (DIY) activities
- virtual tours
- other events and activities.
- National Science Week runs each August and is Australia's national celebration of science, technology, engineering and mathematics (STEM).

The annual event plays a central role in the Australian Government's approach to science engagement and promoting Australians to pursue a career in STEM.

We fund the grants under the Inspiring Australia Science Engagement Programme. There is $500,000 in funding available each year.

For more information, visit **spklr.io/6040tfga**

Visitors at the Martian Garden, run by Plants4Space supported by a National Science Week 2024 Grant. Photograph: Dr Catriona Nguyen-Robertson.



NextGen Nature

Moving from Nature Exploitative to Nature Positive

GORDON NOBLE
Research Director, Institute of Sustainable Futures, UTS Sydney

The You Yangs Regional Park, located between Melbourne and Geelong. Photograph: Enguerrand Blanchy via Unsplash

Everyday thousands of people walk along Princes Bridge in Melbourne, admiring the architecture of the bridge, and pausing to take photos of Melbourne's skyline.

The history of Melbourne is reflected on lamp posts on the bridge, with the City's coat of arms capturing the things that Melburnians in the 1840s believed represented their economic prosperity: a sheep, a black bull, a ship, and a whale.

The extractive nature of Victoria's early economy – of sheep runs to supply wool, commercial whaling to supply oil, beef to feed a hungry population, and shipping to bring in migrants and export raw materials – was something that even by the late 1800's Victorians were beginning to reflect on. By 1884 the Field Naturalists' Club of Victoria were describing the Wilson's Promontory as a future "summer haunt of lovers of nature and lovers of scenery,"[1] with the Royal Society of Victoria itself advocating for a national park.

From our vantage point today, it seems obvious that an economy based on extraction would ultimately face planetary limits. Whilst we are moving to a consensus that we can no longer extract our way to prosperity, we have yet to take the next step that business activities can be nature positive.

But there are some green shoots.

From exploitation to repair and regeneration

Nature positive, which the Australian Government defines as nature that is 'repairing and regenerating rather than continuing to decline',[2] has become the common language that is uniting the different ways in which actions can drive better nature outcomes.

The focus on 'nature positive' came out of the Kunming-Montreal Global Biodiversity Framework (GBF), adopted in 2022 at the fifteenth meeting of the Conference of the Parties (COP 15) of the Convention on Biological Diversity (CBD).[3] The GBF, which Australia is a signatory to, contributes to the achievement of the 2030 Agenda for Sustainable Development,[4] and sets the global vision for biodiversity conservation and restoration by 2050.

The GBF commits parties to "30x30", that is to protect at least 30% of the world's land, freshwater and ocean ecosystems by 2030. The Australian Government has committed to the GBF, and set a national target.[5]

Reflecting the impact that business activities have on nature, a key area of focus of the GPF is to unlock private sector investment in nature. GBF Target 19, which seeks to mobilise US$200 billion per year for biodiversity, focuses on the preparation and implementation of national biodiversity finance plans, and the stimulating of innovative schemes such as green bonds and biodiversity credits.

Certificates for biodiversity projects

The Australian Government has taken biodiversity credits forward as a mechanism to flow finance into nature through the *Nature Repair Act 2023*, which provides a framework for a legislated, national, voluntary biodiversity market in Australia.[6] The Act establishes that the Clean Energy Regulator (CER) is empowered to issue a biodiversity certificate for a 'registered biodiversity project', defined as personal property that is transmissible to other parties. In other words, a biodiversity certificate can be bought and sold in the same way other assets such as housing and shares in a company are.

The Act has yet to be implemented, with the Department of Climate Change, Energy, the Environment and Water (DCCEEW) currently developing technical methods that will

define the eligibility of a biodiversity project to be issued with a biodiversity certificate.[7]

The establishment of biodiversity certificates as personal property does raise questions on what is the financial value of nature? Whilst there is broad consensus that nature *has value*, the idea that investors can be trusted to put a financial figure on that value is not universally believed.

A key question is how a biodiversity certificate market can be developed, which provides confidence to all stakeholders that nature outcomes are being delivered. To answer this, it is useful to understand two key features of a market: independent opinion, and trust.

The evolution of modern markets and brokers

The development of markets itself has been a foundation of economies and societies for centuries. In the United Kingdom, the Domesday Book of 1086 recorded sixty market towns. Historically, it was governments that directed the formation of market towns. The gathering of a market around a town square was not only convenient for traders but enabled local lords to control the activities of the market – and earn income from stallholders.

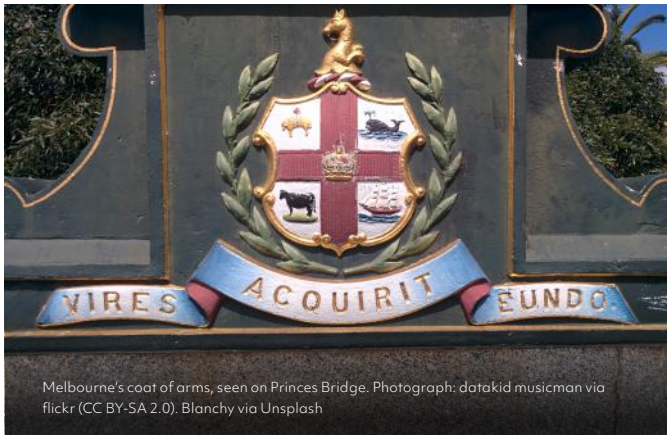
Recognising the potential for unethical practices, mediaeval market towns mandated a role for independent brokers. Not only did this provide matchmaking between buyers and sellers, but also played a role as intermediaries across a wide range of goods including salt, wine, horses, spices, and construction materials.[8] The responsibility of brokers varied, but included informing the buyer of the quality of the goods being purchased. Importantly, brokers were not entitled to engage in trade themselves. Penalties for breaching council regulations included fines, loss of rights to broker, and imprisonment.

Independent research brokers have become a feature of all major stock exchanges providing market participants with their views on the value of a company. Increasingly, environmental, social, and governance (ESG) ratings have been a key feature of independent research.

Fraud triangles and market integrity

An added dimension to the efficient functioning of a financial market is trust. United States criminologist Dr. Donald Cressey examined the rationale behind establishing and enforcing rules for market integrity in 1953.[9] Cressey interviewed 133 inmates in three penitentiaries, who had misused a position of financial trust. His resulting "fraud triangle", which has become the core of financial markets, consisted of three components that work together to contribute to increasing the risk of fraud: (1) opportunity, (2) incentive, and (3) rationalisation. Cressey's work has become the basis of independent regulators that enforce market integrity.

Whilst the establishment of biodiversity certificates issued through the *Nature Repair Act 2023* establishes biodiversity projects as an asset that can be owned and traded by investors, it does not establish an efficient, functioning market. It will be up to market participants and stakeholders to ensure that happens. A key missing element is the provision of independent opinions on biodiversity certificates that supports confidence of those who may buy a biodiversity certificate as well as all stakeholders who have an interest in the development of biodiversity certificates to support nature outcomes.



Melbourne's coat of arms, seen on Princes Bridge. Photograph: datakid musicman via flickr (CC BY-SA 2.0). Blanchy via Unsplash

What is the opportunity for Victoria?

The reality is that the *Nature Repair Act 2023* will soon result in the issuance of biodiversity certificates as personal property. How can Victoria support the development of a market for biodiversity certificates that is based on integrity and trust and in doing so deliver nature positive outcomes? Supporting biodiversity scientists to provide independent opinions for biodiversity certificates is one way to help to build a market based on integrity and trust.

Two steps are proposed:

1. Provide long term funding for the Biodiversity Council, with the objective of enabling it to provide independent opinions on biodiversity projects. This will integrate science into the functioning of a nature market and build stakeholder confidence on the nature outcomes delivered by biodiversity projects through the Nature Repair Act.
2. City of Melbourne - get a new coat of arms that reflects Victoria's ambition to be known for nature positive outcomes, not extraction.

► *Gordon Noble is a Research Director at the Institute for Sustainable Futures, University of Technology Sydney.*

REFERENCES:

1. A History of Wilsons Promontory National Park, Victoria, Australia, Published electronically by the Victorian National Parks Association, May 2009, historyofwilsonspromontory.wordpress.com
2. Environment Protection Australia legislation introduced to Parliament. (2024). DCCEEW. minister.dcceew.gov.au/plibersek/media-releases/environment-protection-australia-legislation-introduced-parliament
3. Convention on Biological Diversity. (n.d.). GBF Home. UN environment programme. www.cbd.int/gbf
4. United Nations. (2015). Transforming Our World: The 2030 Agenda for Sustainable Development. United Nations Department of Economic and Social Affairs. sustainabledevelopment.un.org/content/documents/21252030%20Agenda%20for%20Sustainable%20Development%20web.pdf
5. DCCEEW. (2022). A New Global Biodiversity Framework: Kunming-Montreal Global Biodiversity Framework. DCCEEW. www.dcceew.gov.au/environment/biodiversity/international/un-convention-biological-diversity/global-biodiversity-framework
6. Nature Repair Act 2023 (No.121) (Cth), www.austlii.edu.au/cgi-bin/viewdoc/au/legis/cth/num_act/nra2023155/s34.html
7. DCCEEW. (2024). Methods for the Nature Repair Market. DCCEEW. www.dcceew.gov.au/environment/environmental-markets/nature-repair-market/methods-for-the-nature-repair-market
8. Lars Boerner, Department of Economic History, London School of Economics, Economic History Working Papers, No. 242/2016, Medieval Market Making Brokerage Regulations in Central Western Europe, ca 1250-1700, June 2016.
9. Cressey, D. R. (1953). Other People's money: A study in the social psychology of embezzlement, Free Press

Moss Effect

Bryophytes in Victoria's Ecosystems

DR MATT DELL *and* **DR JOSEPHINE MILNE**
Honorary Associates, Royal Botanic Gardens Victoria

A mix of soil crust bryophytes in arid woodland. Photograph: Dr Matt Dell.

Bryophytes are a group of plants that are familiar to most but are rarely called by their species name – even amongst many botanists. They include mosses, liverworts, and hornworts, and represent some of the smallest plants in the world. Unfortunately, they are among the forgotten species in conservation planning and land management, as their ecosystem requirements and functions are given too little consideration, if any.

Apart from their size, bryophytes possess several traits which allow them to exploit niches not occupied by other plants within an ecosystem. They do not have roots or a complex vascular system like those found in vascular plants (flowering plants, conifers, and ferns), and so most species instead are hydrated mainly by absorbing water at the cell surface.

Small-scale habitats for small-scale plants.

Bryophytes can attach to various surfaces, occupying niches within 'microhabitats', without direct competition from most other plants. To appreciate the complexity of these microhabitats, we need to move from a human-sized view of habitats, and instead consider habitats of all scales. The distribution of bryophytes is determined by habitat conditions at the substrate (the surface they grow on), site, and landscape scales.

We also need to widen our usual expectations of how plants disperse from one area of habitat to another. Bryophytes do not have seeds, instead establishing a new population by dispersing spores, or by shedding fragments and specialised structures from their leafy parts. Dispersal may cover several centimetres to several kilometres, depending on the species and conditions.

There are important differences in how seed plants and bryophytes disperse, and how genes flow within and between populations. In seed plants, a seed (with embryo) may disperse long distances – aided by wind, water or an animal – and in bryophytes the embryo stays attached to the main plant where it obtains nutrients and water.

These differences contribute to how bryophytes and other plants with different life strategies occupy different niches within an ecosystem.

Building and maintaining communities

Bryophyte communities are established through similar processes to vascular plant communities, shaped by changes in environmental conditions that repeat across a site or the landscape. Victoria is rich with different habitat types for plants. The state occupies 3% of the continent and is home to about 20% of Australia's native flora, or about 4,800 plant species, subspecies or varieties.[1,2] Of these, 493 are mosses and 269 are liverworts or hornworts.[2]

The extent of Victoria's area is less important for the number of species found, and more for the 28 bioregions that divide the state based on its broad diversity of landscapes.[4] Some plants occupy habitats that are subject to seasonal snow cover, extreme heat, prolonged drought and other extremes. Bryophytes occupy all landscapes, right to the extreme ends of Australia's climatic range.

By 2022, over half of Victoria's native vegetation and associated habitats had been removed, with the trajectory indicating a continuing net loss today.[3] One consequence is that at least 60 of the 762 bryophyte species are now threatened with extinction.[1] All remaining natural and modified habitats are important for different bryophytes, while some are well known for their abundance and diversity of species.

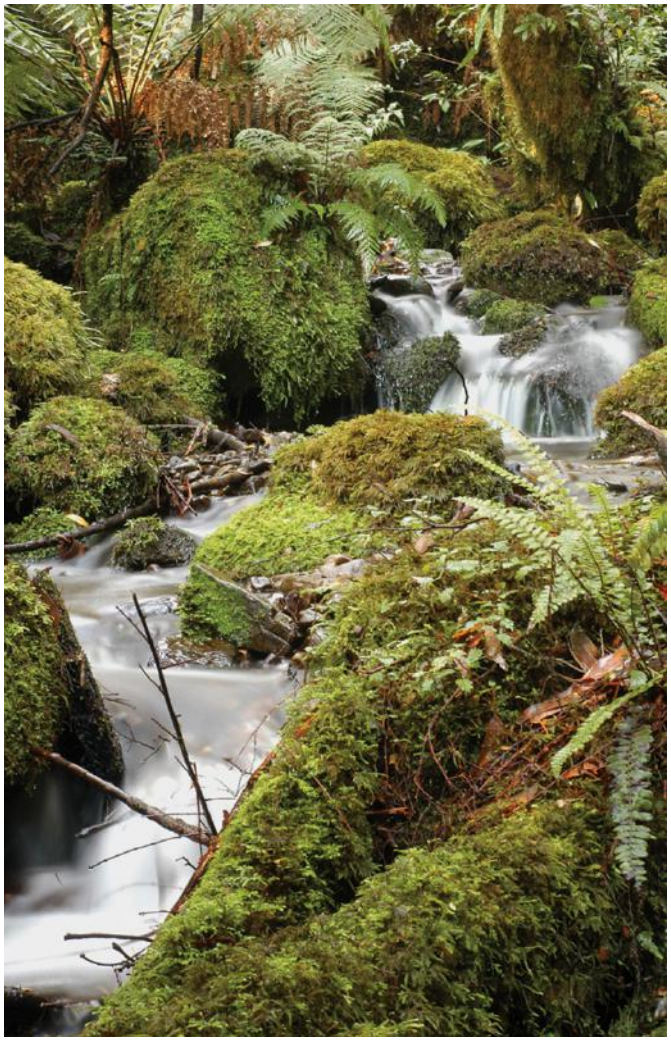
Large Myrtle Beech tree in cool temperate rainforest, in Victoria's Central Highlands. Photograph: Dr Matt Dell.

The right conditions

Cool temperate rainforests are a favourite place for bryologists, which will come as no surprise to those who've spotted the mosses and liverworts they contain. These rainforests are found in sheltered gullies between the Otway Ranges and East Gippsland, where Myrtle Beech (*Nothofagus cunninghamii*) and/or Southern Sassafras (*Atherosperma moschatum*) are common canopy trees.

These forests are typically abundant with bryophytes, and home to some of our most recognisable and common species in Victoria, as well as our rarest species. Conditions beneath the closed canopy are typically humid, allowing bryophytes to flourish on almost every surface, including the upper branches of the tree canopy, tree fern trunks, logs, and soil. Species of cool temperate rainforests find their niche within a competitive environment by adapting to micro-variation in light, water availability, temperature, and substrate conditions. Bryophytes also utilise complex physical, chemical and other processes to deal with competition from other plants, such as allelopathy (chemical inhibition) and resource partitioning (using the same resources in different ways). Cool temperate rainforests are a shrinking ecosystem, which contain a significant proportion of Victoria's bryophyte species, lifeforms and genetic diversity.

Riccia crinita (liverwort) with water droplets on fringing hairs of the thallus. Photograph: Dr Josephine Milne.



Riparian habitat in cool temperate rainforest with abundant bryophytes. Photograph: Dr Matt Dell.

Soil ecosystems and arid zones

Bryophytes are not restricted to wetter ecosystems; they are also found in dry woodlands and arid ecosystems. When conditions are dry, they are barely noticeable, but after rain, hues of green become visible on logs on the forest floor, around the base of trees, shaded sides of rocks and soil depressions as the tiny mosses and liverworts that occupy these niches hydrate.

Bryophytes have a number of characteristics that help them to survive harsh conditions between rain events, and through the dry season. Mosses can form dense cushions where water is trapped between overlapping leaves or closely packed stems, which helps retain moisture for extended periods. Others have leaves which curl and twist upon drying to reduce water loss, but will unfurl in seconds after a short shower or heavy dew. Colourless hair points on moss leaves or on the surface of liverworts both reflect the sun's rays, and also capture droplets of water for rehydration. These features, common in mosses and liverworts forming the living crust on soil, protect the soil from wind and water erosion. Soil crusts also assist with the absorption of water into soil and provide microhabitat for seeds to germinate.

Mosses and liverworts often colonise bare soil. Following fire in woodlands, mosses such as *Ceratodon purpureus* and *Funaria hygrometrica* (identified by the orange to red patches they form), are some of the first soil colonisers protecting exposed soil. Some bryophyte species can also occupy saline ecosystems such as saltmarsh. The tiny liverwort *Monocarpus sphaerocarpus* is one example, found growing on sub-saline soils around saline lakes dominated by samphires (salt-tolerant plants). It is usually found around the base of Beaded Glasswort (*Salicornia quinqueflora*), but is rarely collected due to its small size and ephemeral (short lasting) nature. Little is known of the duration of its colonies and its life history.

Whether annual or perennial, soil bryophytes have the ability to regenerate or establish quickly following disturbance, making way for other plants to establish over time.

Going to extremes

The alpine biome in Victoria offers another range of ecosystems where bryophytes thrive and contribute to unique high-elevation communities. Alpine peatlands occur above 1200 m above sea level, and include heathlands, grasslands, fens, alpine ponds and tea-tree thickets. These are under snow for some months of the year, and may also experience hot and dry conditions in summer. Sphagnum mosses are perhaps the most commonly associated bryophytes in alpine peatlands. They are widely referred to as "ecosystem engineers" for their role in influencing hydrology, soil chemistry, and the species composition of peatlands.

They are highly efficient at absorbing and storing water – many more times their dry weight – around the outside of their branches and leaves. They thrive in low nutrient, acidic soils which they have a significant role in maintaining for the preservation of their own habitat. Exploration of alpine peatlands will reveal many other bryophyte species, each with their own ecological functions. Larger mosses such as *Sphagnum cristatum* and *Polytrichum commune* create hummocks that provide microhabitat variation for other plants and animals. The properties of sphagnum and other mosses have resulted in them being used by humans for centuries, for a range of purposes from insulation, to bedding, to wound dressing.[5,6]

Despite the many extremes these bryophytes deal with, they can dominate where other plants struggle to establish. They are key to the formation of peat and its capacity to retain moisture, slow down water runoff and sequester carbon.

Interactions with animals (big and small)

Bryophytes are used by birds throughout the world for nest building, with some species favouring mosses over other materials. Mosses are not only good insulation, but they also stay green and camouflaged amongst vegetation, offering added protection against potential predators. Bryophytes (for one reason or another) are not consumed by most animals. Invertebrates are commonly found living amongst their leaves, but they seldom eat bryophytes. Mosses have been recorded amongst the varied diet of some bandicoot species; however, it's not known if the bandicoots seek them out directly, or instead consume them while foraging for other foods.

Lobes on the leaves of some bryophytes hold a reservoir of external water. Within these, microscopic invertebrates including rotifers, nematodes, and tardigrades have been found living their lifecycle. Tardigrades may consume the content of bryophyte cells, but these animals also seek algae and microscopic animals to feed on.[7]

Bryophytes often provide the only habitat for these highly diverse and microscopic animals at the bottom of the food chain. Mats of mosses and liverworts harbour larger invertebrates also and it is not uncommon to see these turned over by foraging birds and mammals on the forest floor. There is no doubt that there are many more interactions between bryophytes and animals than are currently understood.

Discovering more about bryophytes

Anyone with an interest in the natural world will have much to gain from a closer examination of bryophytes. The many niches they occupy can be explored within a single rainforest patch, alpine grassland, samphire shrubland, rock outcrop, coastal dune or even urban environment. Placing a moss or liverwort under the microscope will reveal a miniature world of other organisms which live amongst their varied forms. Bryophytes have an aesthetic charm which is observed throughout the world. Their role in ecosystems contributes significant value to biodiversity, however yet to be fully appreciated.

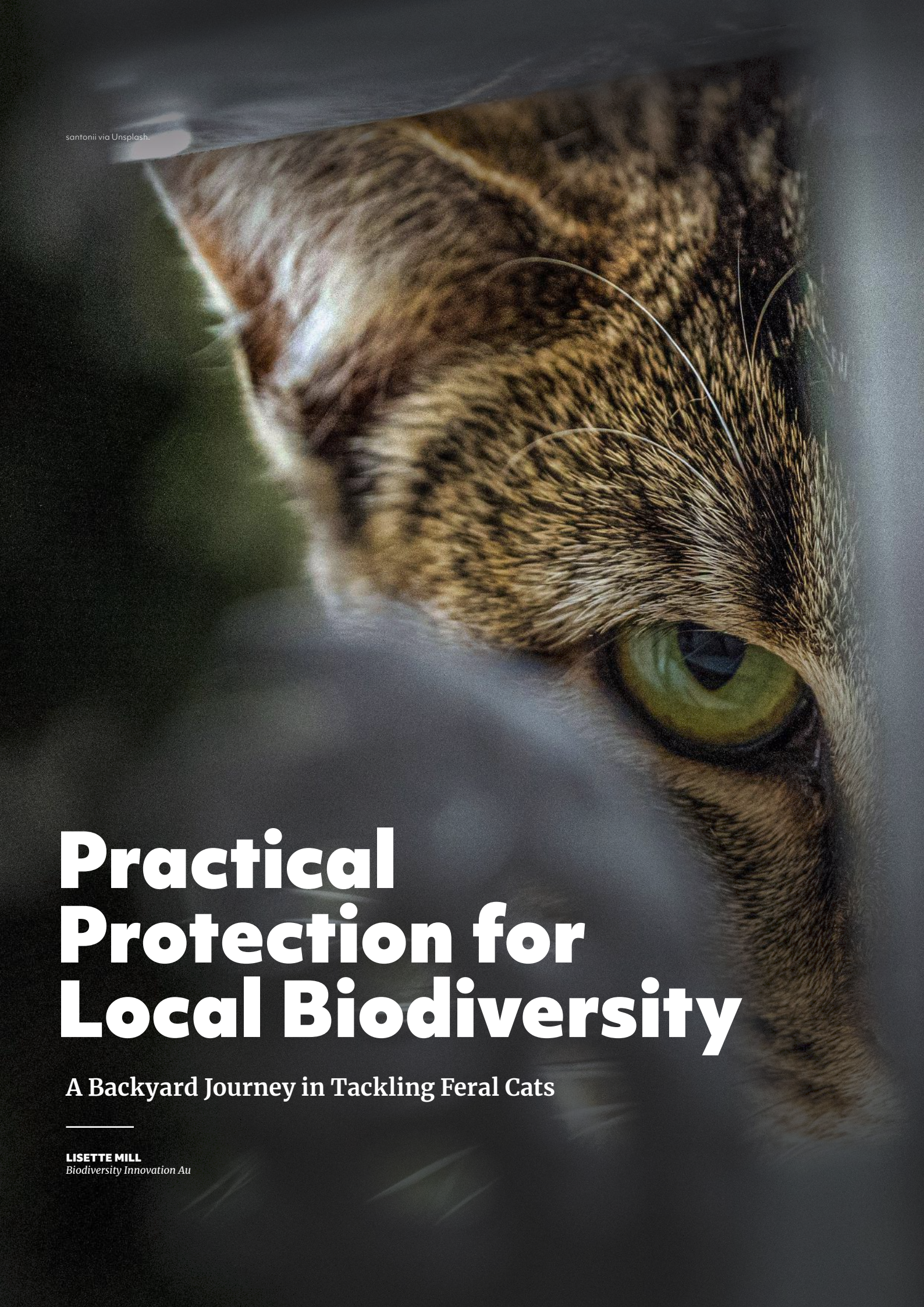
Archegoniophores of the liverwort *Asterella drummondii*. Photograph: Dr Matt Dell.

► *Dr Matt Dell is an Honorary Fellow with the School of Life and Environmental Sciences (Deakin University, Melbourne) and an Honorary Associate at the Royal Botanic Gardens Victoria. His current projects include ecophysiology studies of threatened plants, bryophyte functional trait ecology and biogeography.*

Dr Josephine Milne is an Honorary Associate at the Royal Botanic Gardens Victoria. She was the Collections Manager at the National Herbarium of Victoria and now is retired but continues to work on various bryological projects. Currently with a colleague from Canberra, she is focusing on the species diversity, adaptation, distribution, and conservation of bryophytes of Australian Mediterranean climate areas.

REFERENCES:

1. DEECA. (2024). Flora and Fauna Guarantee Act Threatened List. DEECA. www.environment.vic.gov.au/conserving-threatened-species/threatened-list
2. DEECA. (2024). Victorian Biodiversity Atlas. DEECA. www.environment.vic.gov.au/biodiversity/victorian-biodiversity-atlas
3. VAGO. (2022). Offsetting Native Vegetation Loss on Private Land. Victorian Auditor-General's Office (VAGO). www.audit.vic.gov.au/report/offsetting-native-vegetation-loss-private-land
4. DEECA. (2019). Bioregions and EVC benchmarks. DEECA. www.environment.vic.gov.au/biodiversity/bioregions-and-evc-benchmarks
5. Robin Wall Kimmerer. (2021). Gathering Moss. Penguin UK. ISBN 978-0-87071-499-3.
6. Drobnik, J., & Stebel, A. (2017). Tangled history of the European uses of Sphagnum moss and sphagnol. Journal of Ethnopharmacology, 209, 41–49. doi.org/10.1016/j.jep.2017.07.025
7. Glime, J. M. (2017). Chapter 1 - The Fauna: A Place to Call Home. In Bryophyte Ecology, Volume 2: Bryological Interaction. digitalcommons.mtu.edu/bryophyte-ecology2/1



santonii via Unsplash.

Practical Protection for Local Biodiversity

A Backyard Journey in Tackling Feral Cats

LISETTE MILL
Biodiversity Innovation Au

Photograph: Lisette Mill

There are plenty of "bad cats in the bush" stories, and their impact is significant.[1,2] We know cats are responsible for killing more than 1.6 billion native animals every year – and that number isn't going to change itself.[1]

Yet we only hear the negative stories – a problem that needs to be addressed, not the positive steps that we as individuals can personally make to help change the big picture. As with reporting on the impacts of climate change or any other form of 'bad news' that people feel they have no stake in or control over, this drives audience disengagement.[3]

I think a part of that problem lies in environmental conservation messaging, which is focused on the idea that only experts or "big conservation" can address cat predation of native wildlife in Australia. These stories suggest 'someone else is sorting it', so communities think its in the hands of governments, conservation peak bodies, or local councils. This means local people aren't stepping up to the responsibility of controlling local cats for positive change where they live and work.

Feral cat populations urgently need to be controlled. The challenge is enormous, and requires 'boots on the ground', yet nothing will change if we wait around for someone else to do something. We need the media, politicians, government, invasive species organisations, and conservation agencies to encourage and empower people to take individual responsibility in addressing the impacts of outdoor cats.

Progress may be possible when every Australian has an understanding, and ideally a direct experience, of the positive changes made for our native species when we remove exotic cats from the ecosystem as invasive predators. Animal management can be an intimidating activity to get started with, but there are simple tools and processes to help you get underway.

To demonstrate, here is my story of the excellent results to date from the local cage trapping of feral cats in a rural part of south-west Victoria called Laang. So far this year, we have trapped 13 cats in our garden. Of these, 12 were declared feral by Council Authorised Officers.

Seeing the difference

Before I begin, I should stress that I don't hate domestic cats! We also have our own pet cats, safely contained 24/7 indoors.

As a result of keeping our cats inside, cage trapping those in our garden, and a live trapping program for exotic black rats and mice, this year we have seen the return of native bush rats to our garden, who join the native swamp rats that came back last year. Those two native species will actively defend their territory to prevent the introduced black rats from re-establishing.

Additionally, a small covey of native stubble quail has started to cross our lawn semi-regularly. When I garden or do anything outside, the little native birds follow me around. I have found that I no longer need to use pesticides for aphids, codling moths, pear slugs, or grapevine moths. I also don't need to bait for slugs and snails anymore.

Over summer this year, a wild blue tongue lizard started to come and share my fruit on the front step each morning. Native agile antechinus have adopted our verandah and machinery

sheds, and hunt the insects and exotic mice that try to build up their numbers there.

I recognise this sounds idyllic, but the reality is simply that removing invasive predators – in this case, introduced cats and rats – has given the indigenous ecosystem a chance to restore balance.

As you'd expect, I thought all of this was pretty good! We've set up cameras to monitor trails, and observe both the friendly and feral fauna. Recently, we saw something marvellous for the first time since a particular trail camera was installed in 2023: a tiny native sugar glider left the safety of the nearest tall trees on the road reserve 30m away, and came to our front step. It was deliberate.

To get to our step, this sugar glider had skipped across no-man's land. For an animal who only has "flight" or "hide in a tree hollow" as a means of escape from a predatory cat, it represents a significant change in behaviour.

The glider had tried several times to try and get *into* the feral cat cage trap. We realised that it had followed the scent trail, to eat the little bits of raw meat I sprinkle outside the trap to lure cats (sugar gliders are omnivores).

Changing an established point of view

These sugar gliders, possums, skinks, lizards, native rodents, birds, frogs, bandicoots – all the native species – that *can* live with us in our local environments, most often don't, because of cats. Feral, stray, and pet cats – there is little distinction when it comes to which group will catch and eat a native animal. When outdoors, your pet cat isn't turning down a native bird because there's tinned cat food at home.

I believe the reason that people *don't* manage cats where we live is because not enough is said about the positive that comes when we *do*.

There isn't enough evidence shared of how a few simple actions can support the return of native animals to your local environment. The steps are easy:

1. Confine your own cats to your property.

"Catios", enclosed cat runs, and keeping cats indoors are all well-researched solutions to the very real problem of roaming cats killing wildlife. Cats cannot switch off their instinct to kill. Even very well-fed and pampered pet cats still kill/injure/terrify wildlife. Most of those incidents you will never see. Agriculture Victoria has a number of ideas available on their website.[4]

Our cats have adapted perfectly well to being indoor cats. Yours will too!

2. Trap cats that come to your property.

Talk to your local council – you may be able to borrow a cat trap from them. Alternatively, you can buy an approved humane cage trap and start catching cats. If a cat is on your property and not your cat, then you can legally cage trap it.

From there, you contact your local council again and ask them to collect the trapped cat from the cage. They will check the cat for a microchip and, if no chip is detected, the cat will be impounded. If no owner comes to claim the cat, it will be either put up for adoption or, if injured/feral, it will be humanely euthanized by a vet.

You can familiarise yourself with the cat ownership and control laws of Victoria,[5] and talk to council local laws officers before you start cage trapping.

Practical tips for cage trapping cats

1. Have the right attitude. Just because the cat isn't your pet and will kill natives, doesn't mean you can be cruel. No hooks, no poisons, no leg-hold or illegal gin traps, no letting your pets harass a caught cat in the cage. Let your goal be to catch the cat on your property as quickly as possible, and hand it to the council with legislated authority as quickly as possible.
2. Be mindful that cats can carry and spread diseases. Cats can transmit the parasite *Toxoplasma gondii* to humans through contact with faeces. When handing a cage, and any parts that the cat has fouled, make sure you wear disposable gloves. To be safe, keep your pets and family away from the cat trap.
3. As a general rule of thumb, use a trap that at a minimum would fit the body of a Kelpie dog if it crawled inside.
4. Cover the trap exterior with an insulating shield, so that any cat trapped is not exposed to the weather. Wrapping the back half of the cage with a sunshade used in car windscreens can work well. Not only does it help keep the cat weather protected, it also protects it from other cats, dogs, foxes, and other animals that may try to harm it. The darkness of the cover also helps any cat trapped feel secure and calm. Again, don't be cruel to the animal.
5. Use rubber matting or folded thick newspaper over the wire floor of the trap. Cats don't like the feeling of wire on their feet. Make sure what you use isn't covering the treadle plate that triggers the trap, or obstructing the door when it closes. If the floor covering gets ripped up and fouled, wear gloves to remove it and put it in the rubbish bin. Rubber mats last longer and they do not have to be removed after each cat. The scent a cat leaves in the trap will sometimes attract the next cat – especially territorial Tomcats.
6. Use any meat as bait. Fried chicken is good (de-boned so the cat does not choke). Raw mince, tinned mackerel, and commercial cat food are also good. Different meats work on different cats, so if you have a cat visiting and it doesn't get caught with the meat you used after 16 hours in the trap, remove the meat and try a different one. Don't leave the meat you use in the trap until it becomes rancid – fresh is best.
7. Set your trap in a place on your property where it is sheltered from human view and roaming dogs, but where a cat has free access to it. Secure it to a fixed object with a bike lock if you're worried about it being stolen.
8. Only set up traps on your private property. You can only legally trap cats where you are the property owner.
9. Check the trap every eight to twelve hours. Some cats only come at night. If so, only set the trap at dusk and check first thing in the morning. Traps catch things other than cats, so you need to be home and checking and releasing any non-cats caught in a timely fashion to minimise harm. This is especially important in very cold or hot weather.

BOTTOM LEFT AND TOP RIGHT: Cat trap in action: Feral cats kill 1.6 billion native animals every single year.[1] If your cat isn't locked safely inside, it's likely contributing to that number. Images: Lisette Mill.

Positivity for the future

Looking back over this year and seeing now what a difference cage trapping feral cats has made to the lives of the free living wild native fauna using our property, I can see it has all been worth it. Onwards.

I know that I cannot win the big war on cats in Australia by myself. But I can win it here, and that is what matters to the wild things here with us in this place we call home. You can win at your place too - we can all support native species where we live.

▶ *Lisette Mill is an inventor, innovator, and conservation consultant. Her business, Biodiversity Innovation Au, advises on invasives, shelterbelts, and conducts biodiversity surveys. Current projects: Canid Pest Ejector lure trails, Bandicoot Motels, salt marsh fauna surveys, Farm Biodiversity Action Planning, and Pop-Up-Puddle Biodiversity Survey Kits. Follow Lisette's regular posts on LinkedIn (***linkedin.com/in/lisette-mill***) or email* ***biodiversityinnovationau@gmail.com***

REFERENCES:

1. Tackling the Feral Cat Pandemic: A Plan to Save Australian Wildlife. (2020). Commonwealth of Australia. aph.gov.au/Parliamentary_Business/Committees/House/Former_Committees/Environment_and_Energy/Feralanddomesticcats/Report
2. Legge, S., et al. (2020). Cat-dependent diseases cost Australia AU$6 billion per year through impacts on human health and livestock production. Wildlife Research, 47(8), 731. https://doi.org/10.1071/wr20089
3. Why Constructive Journalism? (2024) Constructive Institute. https://constructiveinstitute.org/why
4. Free standing cat enclosure. (2020, September 1). Agriculture Victoria. https://agriculture.vic.gov.au/livestock-and-animals/animal-welfare-victoria/cats/enclosures-and-fencing/free-standing-cat-enclosure
5. Legal requirements for cat owners. (2022, January 10). Agriculture Victoria. https://agriculture.vic.gov.au/livestock-and-animals/animal-welfare-victoria/cats/legal-requirements/legal-requirements-for-cat-owners

Land of the Birds

What Sets Australia's Avian Life Apart?

READE BARNETT
Geologist and Environmental Scientist, The University of Melbourne

The New Holland Honeyeater. Photograph: Jean and Fred Hort (CC BY 2.0).

Do you ever wake up to the cheerful chirps of rainbow lorikeets? Or the gentle warbles of the magpie? For many of us living in Australia, the day often begins with the melodious greeting of birds perched in nearby trees, on rooftops, fences, or even outdoor furniture. While these morning melodies are part of our daily lives, many of us are unaware of how unique and special the birds around us are.

Australia is home to a rich diversity of birdlife, with over 830 species - nearly one-tenth of the world's bird species.[1] Around 45% of these are endemic to Australia, meaning they are found nowhere else in the world.[1] Not only is Australia's birdlife remarkably species-rich, but its birds are very distinctive.

All the colours of the rainbow

Australia's birds are renowned for their unique physical characteristics – most notably, their dazzling colouration. Many groups, such as parrots, cockatoos, pigeons, kingfishers, and fruit doves, exhibit vibrantly coloured feathers. To have birds as colourful as these in our own backyard is certainly unusual by world standards.

Feathered giants

Australia is also home to two of the world's tallest and heaviest birds: the flightless cassowary and the emu.[2] These two birds are likely to have diverged from a common ancestor around 25-30 million years ago.[3] This common ancestor would have lived alongside dinosaurs and is believed to have flown, but the descendant large-bodied birds likely lost their ability to fly as they evolved and diversified.[3]

Not only do our birds offer a marvellous display of physical beauty, but they also exhibit unique behaviours. As biologist Tim Low notes, compared to birds in other regions of the world, Australia's birds are "more likely to be intelligent, aggressive, loud, long-lived, ecologically powerful and to live in complex societies."[4] But why is this the case? And what makes our birds so unusual?

Isolation: the catalyst for evolution

Australia's unique birdlife owes much of its distinctiveness to the continent's geographic isolation. For millions of years, Australia was part of the ancient supercontinent Gondwana.[5] Around 35 million years ago, Australia completely separated from its Gondwana neighbour Antarctica, and it has remained geographically isolated since.[5]

This isolation enabled Australia's bird inhabitants to evolve separately. Without the influx of bird species from neighbouring landmasses, our birds adapted to a diverse range of habitats and ecological niches on their own. As a result, Australian birds have developed distinctive behaviours and adaptations.

Fighting for food

Australia's distinctive Eucalypt forests have also played a major role in shaping our bird evolution. For example, Australian honeyeaters evolved to utilise long, curved beaks and "brush-tipped" tongues that allow them to extract nectar thinly spread over large surface areas on flowering *Eucalyptus* and *Grevillea*.[6]

The nectar from *Eucalyptus* and *Grevillea* is a highly "fought-after" resource among Australian birds.[4] Unlike bird species in other regions of the world, Australian birds are extremely territorial and aggressive. Honeyeater family birds such as the wattlebird and noisy miner fend off other birds to defend and guard their nectar sources - this could explain why Australian birds are notably raucous and bombastic. However, any bird driven away from one plant will only move to the next, and is therefore continually moving pollen between them. So, perhaps it's a good thing Australian birds fight like children!

Unforgiving environments

Many scientists believe that Australia's harsh and unforgiving climate is what makes its birds unique.[7] Australia's environment ranges from arid deserts to lush, wet tropical rainforests. This diversity of climatic conditions has forced bird species to be innovative and adaptable, and to evolve in extraordinary ways.[8] In fact, most of the world's bird species (including all songbirds and parrots) can trace their ancestry back to Australia.[9]

But land clearing and Australia's changing bushfire regimes are driving our highly evolved birdlife to the brink of no return.

Whether you're a seasoned ornithologist, a casual birdwatcher, or simply someone who appreciates the wonders nature has to offer – Australia's birdlife is something we should all appreciate and try our best to protect. Next time you hear the melodies of our feathered friends, remind yourself of the incredible journey it took for them to exist as they are.

▶ *Reade Barnett completed a Master of Ecosystem Management and Conservation at the University of Melbourne.*

REFERENCES:

1. Chapman, A.D. (2009). Numbers of Living Species in Australia and the World - Detailed discussion by Group: Chordates. Australian Biodiversity Information Services. https://www.dcceew.gov.au/science-research/abrs/publications/other/numbers-living-species/discussion-chordates
2. Australian Geographic Staff. (2018, October 9). Australia's big birds. Australian Geographic. https://www.australiangeographic.com.au/topics/wildlife/2018/10/australias-big-birds/
3. Rainforest Rescue. (2023). Save the Cassowary: Evolution. https://www.rainforestrescue.org.au/save-the-cassowary/evolution
4. Low, T. (2016). Where Song Began. Yale University Press.
5. Encyclopædia Britannica. (2019). Australia - Geologic history. In Encyclopædia Britannica. https://www.britannica.com/place/Australia/Geologic-history
6. Paton, D. C., & Collins, B. G. (1989). Bills and tongues of nectar-feeding birds: A review of morphology, function and performance, with intercontinental comparisons. Austral Ecology, 14(4), 473–506. DOI: 10.1111/j.1442-9993.1989.tb01457.x
7. Heathcote, A. (2020, January 23). Australia's birds have evolved with the continent's extreme weather, but not under these circumstances. Australian Geographic. https://www.australiangeographic.com.au/topics/wildlife/2020/01/australias-birds-have-evolved-with-the-continents-extreme-weather-but-not-under-these-circumstances/
8. Meredith, P. (2017, November 24). Feathered geniuses: birds are much smarter than we think. Australian Geographic. https://www.australiangeographic.com.au/topics/wildlife/2017/11/bird-intelligence/
9. Stiller, J., et al. (2024). Complexity of avian evolution revealed by family-level genomes. Nature, 629, 851-860. DOI: 10.1038/s41586-024-07323-1

Bee Aware

Varroa destructor is Here to Stay

LUCY HAYWARD
BioSciences Student, The University of Melbourne

One third of our global food production depends on bees. In Australia, around 35% of crops need bees for pollination.[1]

Varroa destructor – yes, that's its scientific name – is a tiny mite that has decimated honeybee colonies around the world. And an outbreak of this destructive parasite has been confirmed for the first time in Victoria near Mildura.[2]

Also known as the varroa mite, it is a parasite for honeybees of all life, weakening entire colonies. It is one of the major factors contributing to widespread colony collapse disorder, when most worker bees in a colony disappear.

The mites spread between bee colonies through contaminated hive equipment and by hitchhiking on foragers as they are agile and transfer through contact.[3]

Until last year, Australia was the only continent on Earth – excluding Antarctica – free of the pest. But, despite strict biosecurity laws and protocols, *Varroa destructor* breached our borders in June of 2022.[2]

Following an unsuccessful attempt to eradicate the pest, in September 2023 the Australian Federal Government announced they were abandoning their eradication strategy, turning instead to management.[2] Now, these pests have broken through into Victoria's ecosystems too.

A forbidden fatty snack

Scientific literature for the past five decades has stated that *Varroa destructor* feeds on the blood (haemolymph) of honeybees. Samuel Ramsey – a PhD student at University of Maryland College Park at the time - noticed that this understanding was cited back to one paper. When he translated the text from its native Russian, he found nothing that mentioned the mites' feeding behaviours. What we knew about the parasite feeding on the bees was based on a single mistranslation.

Ramsey examined varroa mite excrement and found that it contained a high level of purine - an observation that he was reminded of when visiting his parents, and it was his father's diagnosis of gout that tipped him off. Gout is a form of arthritis that occurs when uric acid crystallises in the joints of the body, and uric acid is a derivative of excess purines. Upon researching the best meal plans for his father, Ramsey discovered that the number one thing listed as what you shouldn't eat with this condition was liver. At that moment it struck him that maybe varroa mites were feeding on the bees' liver (or rather, their equivalent).

While bees don't have livers per se, their fat body tissue is an analogous structure, essential for the bee's immune response and survival over winter. With further testing, Ramsey found that the fat body was the main source of varroa mites' sustenance) meaning that a large amount of varroa research has been done looking up the wrong hypothetical tree.[4]

A bee-llion dollar industry

European honeybees are a large and lucrative industry in Australia, worth more than $14 billion annually.[1] There is significant concern for the effect of a varroa establishment disrupting these systems.

Commercial pollination services see the movement of hundreds of hives across state borders, increasing the risk of the pest spreading. In the United States and parts of Europe, *Varroa destructor* has wiped out 95-100% of wild European honeybee populations within a four-year infestation period.[5] This trend is likely to occur in Australia and it will have a significantly detrimental influence over the agricultural industry as many crops depend on pollination by wild honeybees.

Biocontrol agents are of strong consideration due to the aversion to pesticide use that would affect the health of bees too. One contender is a predatory mite, *Stratiolaelaps scimitus*, which does not harm honeybees but has been found to attack *Varroa destructor* in the lab (could this be "mite-ception"?).[6] However, field tests were less successful and more rigorous studies would need to be done before this could be applied at a large scale – we can't be having another cane toad situation.

Varroa mite does not appear to attack native bees, and there is the possibility that these native species will benefit from the outbreak due to reduced competition with European honeybees.[7] Although it is also possible that they will suffer indirect effects due to increased disease transmission through a varroa mite vector.

▶ *Lucy Hayward is a Master of Science student in the School of BioSciences at the University of Melbourne.*

REFERENCES:

1. DAFF. (2022). Honey bees. Agriculture Victoria. www.agriculture.gov.au/agriculture-land/farm-food-drought/hort-policy/honeybees
2. Varroa mite (Varroa destructor). (2022). Outbreak. www.outbreak.gov.au/current-outbreaks/varroa-mite
3. DAFF. (2024). Varroa mite frequently asked questions. agriculture.vic.gov.au/biosecurity/pest-insects-and-mites/priority-pest-insects-and-mites/varroa-mite-of-honey-bees/varroa-mite-frequently-asked-questions
4. Ramsey, S. D., et al. (2019). Varroa destructor feeds primarily on honey bee fat body tissue and not hemolymph. Proceedings of the National Academy of Sciences, 116(5), 1792–1801. DOI: 10.1073/pnas.1818371116
5. Rondeau, S. (2019, January 27). Mite versus mite: The search for an effective way to save honeybees. The Conversation. theconversation.com/mite-versus-mite-the-search-for-an-effective-way-to-save-honeybees-108873
6. Heard, T., et al.(2022, August 16). Varroa incursion – what does it mean for native bees? Australian Native Bee Association. www.anba.org.au/notices/varroa-incursion-what-does-it-mean-for-native-bees/

Commercial keeping of European honeybees is a large industry in Australia. Photograph: Hansjorg Keller via Unsplash

Xenesthis immanis are formidable guardians known to aggressively protect their territory from frog predators. Photograph: Ambrosia10 via Wikimedia Commons (CC BY-SA 4.0).

Tiny Frogs & Tarantulas

An Unexpected Friendship

NYUK MEI LIU
Environmental Science Student, The University of Melbourne

You may have heard of iconic mutualistic relationships (where both species benefit from their interactions with each other) between coral and algae, clownfish and sea anemones, and cleaner fish and sharks.

However, you probably haven't heard about the relationship between tiny frogs and tarantulas. This could be because relationships between frogs and spiders vary across the globe.

In certain ecosystems, frogs feast on spiders, while in others, spiders devour frogs. It's unlikely to find the pair co-existing harmoniously without one attacking the other.

Yet, located in a burrow somewhere in the Amazon rainforest, scientists have observed an unexpected friendship between the Dotted humming frog (*Chiasmocleis ventrimaculata*) and the burrowing tarantula (*Xenesthis immanis*).

What makes this partnership work?

Tarantulas act as a formidable bodyguard for the frogs and provide protection against predators like snakes and other spiders.[1] Adult spiders have proven to uphold their position as a vicious protector, preventing potential frog predators from entering their burrow. Researchers have found them attacking a 90 cm colubrid snake.[1]

Meanwhile, the humming frogs safeguard the tarantula's eggs by eating small invertebrates such as ants (the primary predator of spider eggs) that are attracted to the remnants of the spider's prey – which also provide a snack for the frogs.

As such, these small amphibians have been welcomed into the tarantula's burrows, where they live as peaceful houseguests amidst the otherwise aggressive spider family.

Seeing as they share similar lifestyles, they seem to (mostly) get out of each other's way.

Both species remain underground during the day and forage outside the burrow at night. Adult female spiders approach and guard the entrance of the burrow at dusk, while the frogs emerge later in the evening to forage, pushing past or crawling under the towering tarantula to get out. And the tarantula doesn't attempt to attack the frog at all as it does.

Why?

Humming frogs are friends, not food

Tarantulas are nocturnal creatures with poor eyesight, therefore relying on vibrations and chemical cues to recognise their partner frogs.

Humming frogs are approximately 2 cm in length and belong to the Microhylidae (narrow-mouthed frog) family.

While tarantulas are more than capable of preying on frogs of this size, microhylidae secrete toxins on their skin that make them unpalatable. Some juvenile spiders, upon unknowingly capturing these frogs, have been observed to inspect the humming frogs with their mouthparts before releasing them unscathed, learning not to go for them again.[1]

To test whether it was really the toxins keeping the spiders at bay, researchers transferred the skin of the humming frog onto the body of a frog that tarantulas are known to prey on. Four times out of five in the trial, the spiders rejected the frog.[2]

During other trials, various frog species were introduced to tarantulas and found they never killed nor harmed humming frogs, though they ate the others without hesitation. They observed that humming frogs stayed motionless when held, unlike other frog species, which may have spared them from being attacked.

This indicates that tarantulas use chemosensory receptors to detect vibrational and chemical cues to differentiate their friends from food.

This unassuming alliance between tiny frogs and fierce tarantulas is only one of many unique partnerships found in nature. This seemingly odd pair embodies the remarkable bonds that can form in the wild, showcasing mutual support and cooperation despite their differences.

An alliance closer to home

We now know mutualistic symbiosis – a mutually beneficial relationship between species - is the norm for most organisms.

Symbiosis also occurs throughout Victoria's ecosystems. Diverse lichens grow on tree trunks and rocks, providing a suitably moist environment for species of algae or cyanobacteria to grow. In return, the lichens receive some of the carbohydrates produced by photosynthesis. Plant species often live in a close relationship with fungi in the soil.

Even our gut flora represent symbiosis on a massive scale. The diversity and huge numbers of bacteria living happily in our gut that break down food, manufacture vitamins, and tweak our immune system can have a huge impact on our health and wellbeing.

Look around, and you might find symbiosis and alliances between different plant, fungi, and animal species everywhere.

► *Nyuk Mei Liu is currently pursuing her Master of Environmental Science at the University of Melbourne.*

REFERENCES:

1. Cocroft, R. B., & Hambler, K. (1989). Observations on a Commensal Relationship of the Microhylid Frog Chiasmocleis ventrimaculata and the Burrowing Theraphosid Spider Xenesthis immanis in Southeastern Peru. Biotropica, 21(1), 2. DOI: 10.2307/2388434

2. Csakany, J. J. (2003). Some aspects of the relationship between the Peruvian microhylid frog, Chiasmocleis ventimaculata, and a theraphosid spider, Pamphobetus sp. [Master's thesis, State University of New York College of Environmental Science and Forestry. ProQuest Dissertations & Theses. https://www.proquest.com/openview/e433455b9d0fd3d9f4fe135874ef63a5/1?pq-origsite=gscholar&cbl=18750&diss=y

Sad, dead fish in a lake. Photograph: Dr. Hans-Günter Wagner via Wikimedia Commons (CC BY-SA 2.0).

Could Rusty Water Save the Environment?

RYAN HARPER
PhD Candidate, The University of Melbourne

We do a lot to pollute the environment. We know the harmful effects that microplastics and pesticides can have on aquatic life. However, a pollutant that we often overlook is one you might not expect.

The hormone oestrogen pollutes our waterways, virtually unchanged even by wastewater treatment, and now marine life is subjected to a drug cocktail that contaminates rivers and streams.

The effects of oestrogen are far-reaching

Whilst essential to human development, oestrogen can have disastrous effects on the environment at every point along the food chain.

We expect oestrogen to influence our normal physiology (e.g., puberty, reproduction, and other functions in our bodies). The purpose of additional oestrogen in the contraceptive pill is to disrupt the menstrual cycle – but it is having unintended consequences as it enters the environment and disturbs the normal, delicate hormone balance of many different animals and plants. With the conservation of hormone receptors across different life forms, it can act on the receptors of "off-target" species.

Oestrogen harms plants, negatively affecting root and shoot development, flowering, and germination.[1]

Oestrogen also harms fish. Not only is it carcinogenic to fish, but it also severely impacts their reproductive cycle. In North America, a population of fathead minnows were almost completely wiped out due to the introduction of synthetic oestrogen into their lake.[2] The same study also found that oestrogen can "feminise" male fish, leading them to develop early-stage eggs in their testes.[2]

Oestrogen can hurt you too!

Even if the mental image of shrivelled plants and sad, dead fish doesn't perturb you, oestrogen pollution can harm humans too. Oestrogen pollution has been linked to higher rates of breast cancer in women, and prostate cancer in men.[3,4]

Where is this oestrogen coming from?

It only takes trace amounts of oestrogen in the water to cause these problems, and the concentration of oestrogen in the water is increasing.

The biggest culprit: cattle.

Cattle worldwide were responsible for almost 98% of oestrogens secreted into the environment in 2015.[5] That is fourteen thousand tons of oestrogen. The use of growth hormones in cattle farming results in synthetic oestrogen being

released in their urine and faeces,[1] which finds its way into our waterways, our environment, and eventually back into our drinking water.

Luckily for Victorians, oestrogen pollution levels are not yet high enough to affect our native wildlife.[6] But don't breathe a sigh of relief just yet. Victoria is the third-largest cattle producer in Australia, with an estimated 2.9 million beef cattle in 2023.[7] With a growing population and an increase in cattle farming, oestrogen pollution is expected to increase in the coming years.

This is a growing problem, and we need a solution.

Luckily, materials scientists at Friedrich-Alexander-Universität Erlangen-Nürnberg believe they have the answer. 'Smart Rust': a nanoparticle that can stick to oestrogen and help pull it out of our waterways.[8]

What makes 'Smart Rust' so smart?

Smart Rust is made up of small hair-like molecules that can trap oestrogen. These 'hairs' are attached to *superparamagnetic iron oxide nanoparticles*, or as it is better known: rust. Smart rust can attract many substances, including oil, microplastics, and oestrogen, depending on the particles' coating.

Oestrogen molecules have a bulky steroid body and parts with slight negative charges. If the nanoparticles are coated with compounds that are positive and long, then they can draw the oestrogen molecules in and wrap around them to trap them in place.

These tiny oestrogen-hunters can be introduced into waterways, capturing the polluting oestrogen. It can then be removed from the water using an electromagnetic field that attracts the rust. The benefit of the iron oxide being in superparamagnetic form means that they are drawn to magnets, but not to each other, so that the particles don't clump.

Essentially, Smart Rust could allow us to pull oestrogen from the water using a magnet.

The future of water purification

Smart Rust may provide us with an affordable and efficient way of removing a harmful pollutant from our water and saving the environment. It has already been able to remove much of the oestrogen from water samples in the lab.[8] All that's left is to test it in actual waterways. It could be that in the future, "rusty" water may actually be the safest to drink!

▶ *Ryan Harper is currently doing a PhD in immunology at the University of Melbourne and the Peter Doherty Institute for Infection and Immunity after studying immunology and science communication as part of his Master's degree.*

REFERENCES:

1. Adeel, M., et al. (2017). Environmental impact of estrogens on human, animal and plant life: A critical review. Environment International, 99, 107–119. DOI: 10.1016/j.envint.2016.12.010
2. Kidd, K. A., et al. (2014). Direct and indirect responses of a freshwater food web to a potent synthetic oestrogen. Philosophical Transactions of the Royal Society B: Biological Sciences, 369(1656), DOI: 10.1098/rstb.2013.0578
3. Moore, S. C., et al. (2016). Endogenous Estrogens, Estrogen Metabolites, and Breast Cancer Risk in Postmenopausal Chinese Women. JNCI Journal of the National Cancer Institute, 108(10). DOI: 10.1093/jnci/djw103
4. Nelles, J. L., et al. (2011). Estrogen action and prostate cancer. Expert Review of Endocrinology & Metabolism, 6(3), 437–451. DOI: 10.1586/eem.11.20
5. Zhang, Q.-Q., et al. (2021). How much do human and livestock actually contribute to steroids emission and surface water pollution from past to the future: A global research. Science of the Total Environment, 772. DOI: 10.1016/j.scitotenv.2021.145558
6. Australian Bureau of Statistics. (2024, June 14). Australian Agriculture: Livestock, 2022-23 financial year. https://www.abs.gov.au/statistics/industry/agriculture/australian-agriculture-livestock/latest-release
7. Hassell, K., et al. (2016). No evidence of exposure to environmental estrogens in two feral fish species sampled from the Yarra River, Australia: A comparison with Northern Hemisphere studies. Ecotoxicology and Environmental Safety, 131, 104–117. DOI: 10.1016/j.ecoenv.2016.05.004
8. The American Chemical Society. (2023, August 16). Cleaning water with 'smart rust' and magnets. https://www.acs.org/pressroom/newsreleases/2023/august/cleaning-water-with-smart-rust-and-magnets-video.html

Cattle are responsible for the majority of oestrogens released into the environment[5]
Photograph: Zoe Askew via Unsplash.

1975

Western Port's Next Top Model

SCOTT REDDIEX MRSV
Editor-in-Chief, Science Victoria

In the 1975 *Proceedings of the Royal Society of Victoria*, the focus was on Western Port (at different times referred to as Westernport, Westernport Bay, and Western Port Bay).

The RSV had held the Western Port Bay Symposium at Monash University the previous year, and so the 1975 edition of the *Proceedings* was filled largely with papers that had come out of that symposium.

One of these papers came from W. T. O'Brien (Centre for Environmental Studies, University of Melbourne) and J. B. Hinwood (Dept of Mechanical Engineering, Monash University), who presented *"Some Components of an Ecosystem Model of Westernport Bay"*.

Ecosystems are immensely complex. Every ecosystem is unique, comprising millions of interactions between the different constituent pieces, from the nano to the macro scale. To help us study and understand them easier, we do things like group them by common factors, and focus on different scales depending on what we're focusing on at the time.

Invaluable to this is the development of models, for reasons best summarised by the paper's authors in their introduction: *"A model is a representation of a real system, which can be used to make predictions which can be tested. If a model is incapable of prediction, it is of no interest to resource managers; if it is incapable of verification, it may still be of interest, but the conclusions drawn from its use will be severely limited."*

With respect to Western Port, the authors had recognised that a comprehensive model of processes in the bay was essential for managing its environmental health. To this end, they aimed to develop the Westernport Bay Water Quality Model, as a *"first step towards a total ecosystem model for Westernport."* Their model would predict pollutant levels, better understand the hydrodynamics (i.e., the movement of water, including the tides and currents), and identify the transport patterns of pollutants through the bay.

Ultimately, they aimed to develop a comprehensive ecosystem model that considered both physical and biological interactions, moving beyond the 'traditional'/simpler water quality measures.

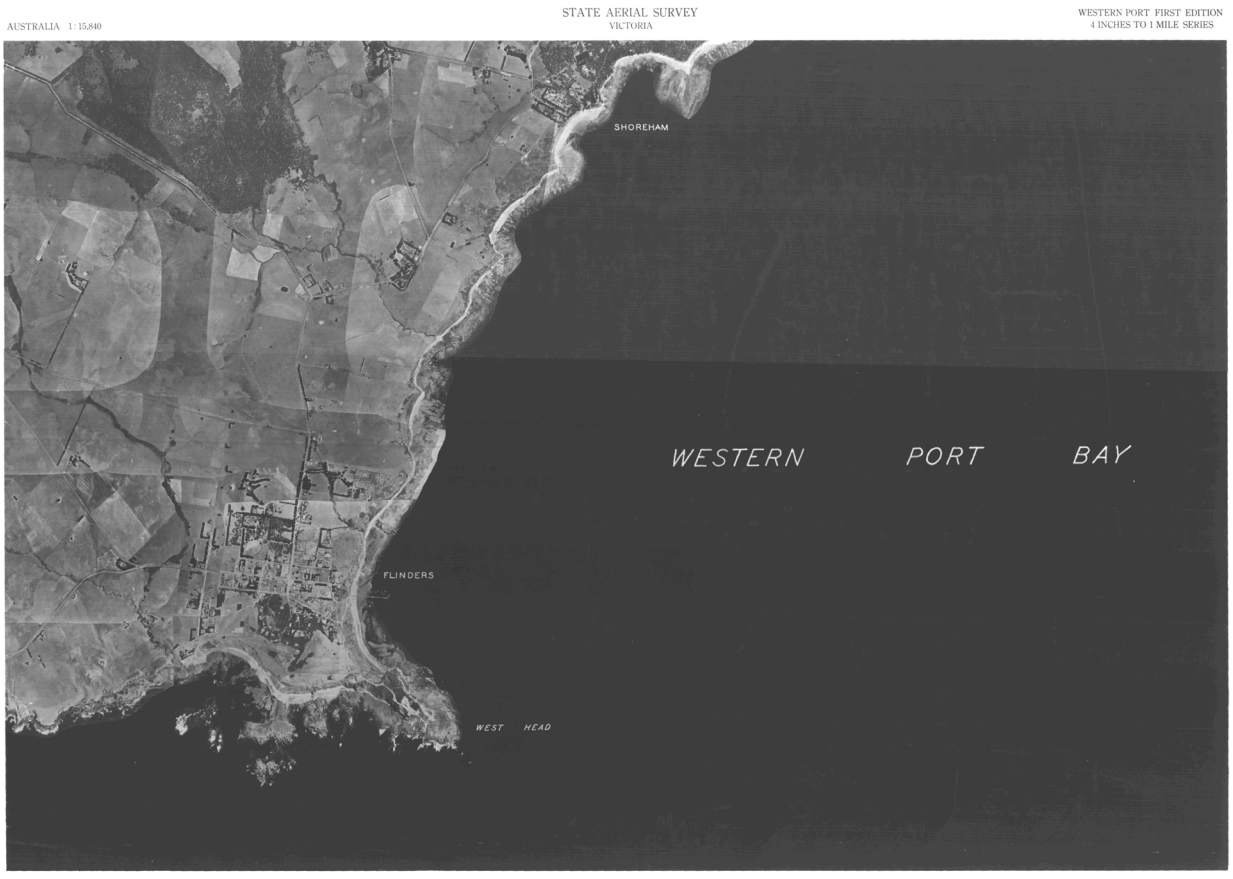
Their model comprised *"a number of computer programs which may be run either independently or as an integrated suite. These programs solve the basic equations of fluid flow and chemical kinetics at each of the thousand or more grid points throughout the Bay."* Encouragingly, they found that the model was able to generate relatively accurate predictions of tidal height and velocities, as well as identifying unexpected 'transport patterns' of pollutants.

While O'Brien and Hinwood recognised the preliminary nature of the model, and *"the need for additional field measurements to verify both the model and the predictions."* They also saw the value of expanding the model to consider biological and chemical factors like *"organic and inorganic phosphorus components, phytoplankton chlorophyll and zooplankton carbon."*

As our environment changes at an increasing rate due to climate change, the development of comprehensive and accurate models are now more important than ever.

FROM:
Proceedings of the Royal Society of Victoria, Vol 87 (New Series), 1975. Article 8 - Some Components of an Ecosystem Model of Westernport Bay. By W. T. O'Brien and J. B. Hinwood.

OPPOSITE:
Flinders, at the entrance to Western Port, photographed as part of the 1957 State Aerial Survey. Photograph: © State of Victoria (Department of Energy, Environment and Climate Action) (CC BY 4.0).


AUSTRALIA 1:15,840
STATE AERIAL SURVEY
VICTORIA
WESTERN PORT FIRST EDITION
4 INCHES TO 1 MILE SERIES
SHOREHAM
WESTERN PORT BAY
FLINDERS
WEST HEAD
APPROXIMATE SCALES
CHAINS
YARDS
KEY TO ADJOINING SHEETS
PHOTO-MAP
WESTERN PORT C3
OR 868 C3
ZONE 7
PHOTO-MAP
WESTERN PORT C3
OR 868 C3
ZONE 7

Inspiring Victoria

inspiringvictoria.org.au

The Inspiring Australia strategy was developed by the Australian Government to increase general engagement and interest in the sciences by Australians. The *Inspiring Victoria* program is jointly funded by the Australian and Victorian governments with the Royal Society of Victoria (**rsv.org.au**).

Inspiring Victoria encourages involvement in STEM through initiatives (such as National Science Week Victoria - **scienceweek.net.au/your-state/vic**) that are governed and delivered by the RSV's program partners:

PUBLIC LIBRARIES VICTORIA
plv.org.au

NEIGHBOURHOOD HOUSES VICTORIA
www.nhvic.org.au

PARLIAMENT OF VICTORIA
parliament.vic.gov.au

MUSEUMS VICTORIA
museumsvictoria.com.au

ROYAL BOTANIC GARDENS VICTORIA
rbg.vic.gov.au

ZOOS VICTORIA
zoo.vic.gov.au

QUESTACON
questacon.edu.au

SCIENCE TEACHERS ASSOCIATION OF VICTORIA (STAV)
stav.org.au

October 2024

Flood waters from the Murray River covered Mildura during the 2022 Victorian Floods. Photograph: Wirestock Creators via Shutterstock.

Collaborate to Improve Climate Change Resilience

Report from the inquiry into the 2022 Victorian Floods

ADEEL SIDDIQI
Research Assistant, Legislative Council, Parliament of Victoria

And **BEN KIMBER**
Communications Adviser, Legislative Council, Parliament of Victoria

Improving resilience to climate change and climate-fuelled weather events is the broad aim of a state parliamentary inquiry's final report into the 2022 flood event in Victoria.

The Legislative Council Environment and Planning Committee's report makes 73 recommendations to the Victorian Government, including for the Government to collaborate more with scientists to understand how modelling can be used to better predict climate change impacts on flooding.

In their respective evidence to the Committee, the Bureau of Meteorology and ARC Centre of Excellence for Climate Extremes noted the link between climate change and an increase in short-duration, high-intensity rainfall in Victoria.

The latter cautioned the Committee about relying on products offered to the government that purport to project extreme rainfall at a very localised scale, asserting that detailed forecasts of this kind are beyond the current state of climate science.

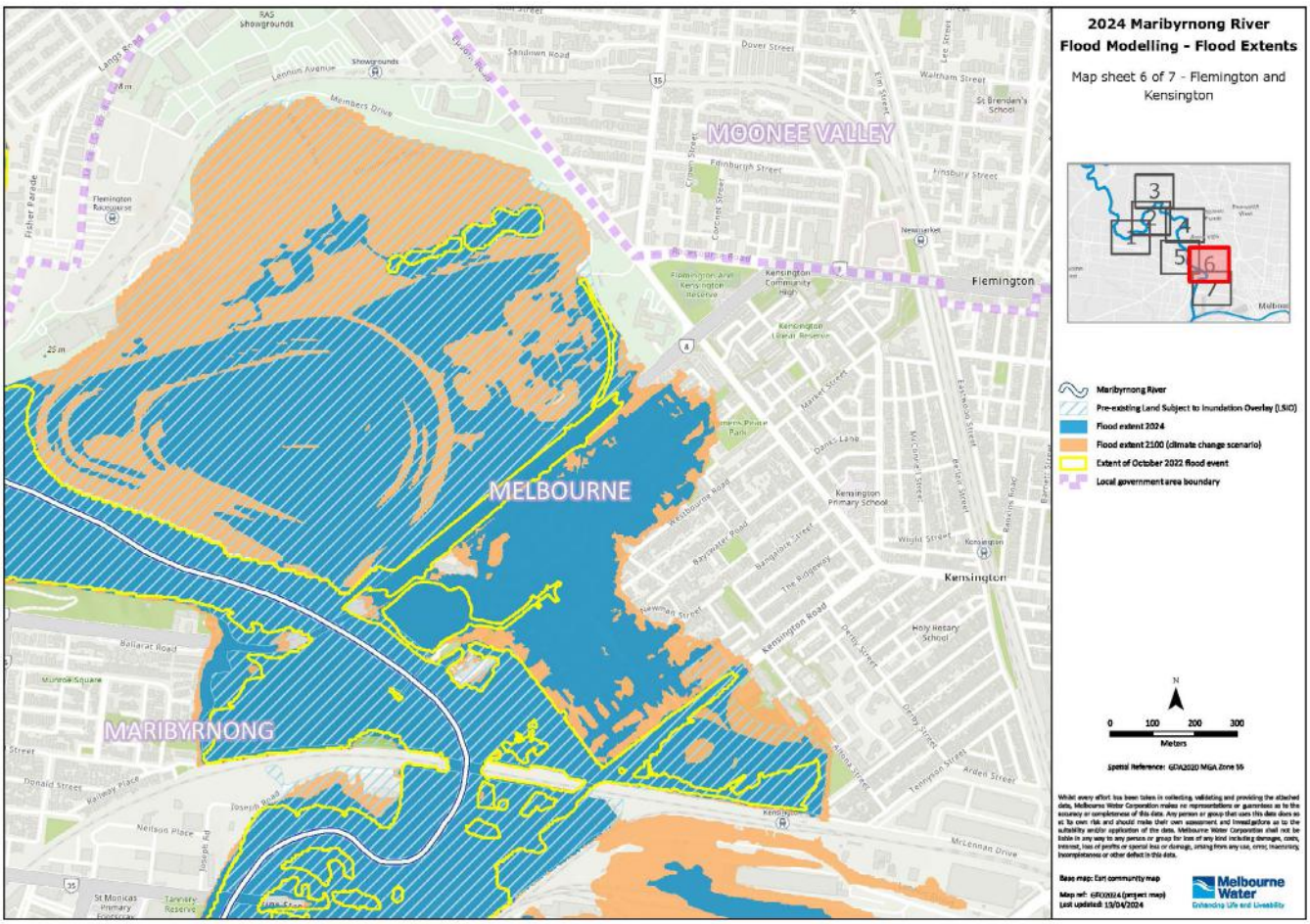
Models informing planning

Modelling is being used by water authorities in both Melbourne and regional Victoria to inform planning regimes. The Committee heard from Melbourne Water about its plans to remodel all of Melbourne's water catchments to incorporate climate change projections to the year 2100, and its intention to use this information to assist with planning processes in potential flood-prone areas.

The updated modelling will be used to produce maps of floods with a 1% chance of occurring or being exceeded, including in 2100.

Working with planning authorities, Melbourne Water will incorporate the 2100 maps into planning schemes, ensuring planning decisions throughout metropolitan Melbourne reflect increased flood risk as a result of climate change.

In response to the 2022 floods in Maribyrnong, Melbourne Water released fast-tracked modelling of the Maribyrnong River catchment.



An example of the flood modelling produced by Melbourne Water showing potential extent of inundation. Image: Melbourne Water.

Flooding along Melbourne's Maribyrnong River

The models project a marked increase in nominal flood depth between 2024 and 2100 in areas adjacent to the Maribyrnong River, including the Kensington Banks development.

In a 2024 1% flood scenario, the model projects Kensington Banks would experience 0.84 m nominal flood depth, whereas in a 2100 flood scenario, this flood depth is projected to almost double at 1.57 m.

Appearing before the Committee, Managing Director of WMAwater and member of the independent Maribyrnong River Flood Review panel Mark Babister highlighted the significance of climate change's impact on flooding in Victoria.

"The chance of the 2022 flood occurring, say, back in the 60s, 70s, 80s or 90s was about 2% each year," he said.

"Because of the warming already today it is about 50% more likely. By 2030 it will be about 60% more likely.

"Depending on what CO2 emission scenarios we end up on, it could end up at 2060, at two times more likely and in 2090 it could end up as bad as three times."

Planning for the changing climate

The Committee concluded that regardless of local-scale climate modelling, climate change is having a profound effect on extreme weather events, including floods.

The inquiry's final report urges the Victorian Government to plan for and mitigate the impacts of climate change on the built and natural environment, and for planning authorities to address climate change at all levels of the planning process.

Implementing climate projections into local planning schemes is one way of doing this.

The October 2022 flood event devastated large parts of the state, particularly the northern Victorian areas of Rochester, Echuca, Seymour and Shepparton, and inner-city suburbs surrounding the Maribyrnong River.

After 18 months of research and public hearings, involving dozens of individuals and organisations, the State Government is considering all of the findings and recommendations contained in the 477-page report.

The parliamentary committee, which consists of government, opposition and minor party MPs, is now conducting an inquiry into climate resilience, investigating the main risks facing Victoria's built environment and infrastructure from climate change and the impact these will have on the people of Victoria.

- *Read the floods report and watch a summary of the key findings and recommendations* ***vicparl.news/floodreport***
- *Watch coverage of the floods inquiry, including public hearing highlights at* ***vicparl.news/floodinquiryvids***

Survived and Thrived

Inspiring Victoria Partner Events from National Science Week 2024

DR CATRIONA NGUYEN-ROBERTSON
Chair of the National Science Week Victorian Coordinating Committee

Victoria is home to many ecosystems. Reflecting on Victoria's diverse ecosystems in this edition - both the communities living in different pockets of Melbourne and the changing landscapes housing flora and fauna - one thing holds true: we're stronger together. "Community" extends beyond human collectives to embrace a vast network of amazing, adaptable lifeforms, all of us reliant on each other to survive and thrive in our remarkable planet's dynamic web of life.

For this year's National Science Week, the *Survive and Thrive* presented by the *Inspiring Victoria* program. It explored how we can use science to help flora, fauna, and ourselves not only survive, but also thrive in this changing world.

Survive and Thrive was a series of community-focused events presented in collaboration between Museums Victoria, Royal Botanical Gardens Victoria, Zoos Victoria, and the Royal Society of Victoria for National Science Week, produced by the *Inspiring Victoria* program.

There are 1.5 million specimens in the National Herbarium of Victoria, acting as "botanical time capsules". Photograph: Dr Catriona Nguyen-Robertson.

Journey Beyond: with Katherine Bennell-Pegg (Museums Victoria)

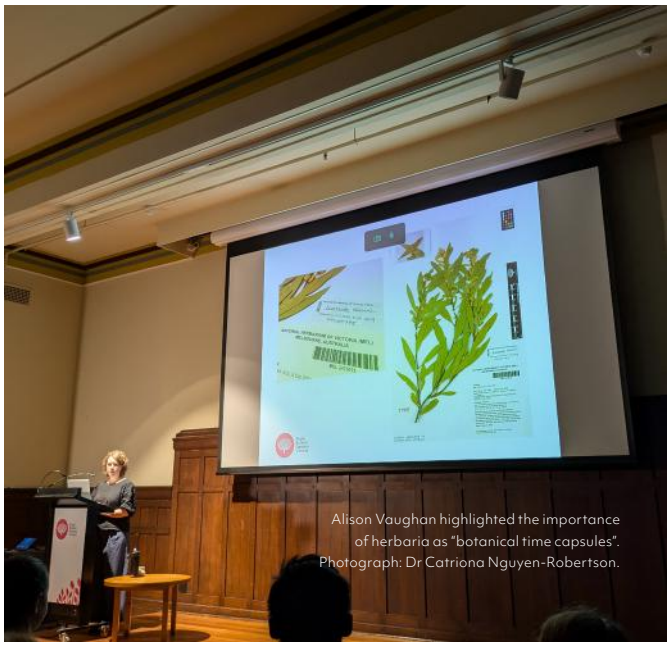
As humanity reaches for the stars and ventures into space, what will we need to survive and thrive in the harsh environment of space? Space is a harsh environment for the human body.

It is not easy to survive in space without the help of science. Nor is it easy to get into an astronaut training program. Katherine Bennell-Pegg is the first astronaut to train under the Australian flag and is Director of Space Technology at the Australian Space Agency.

In high school, when asked to write down three different career options, Katherine only wrote down one – astronaut – and refused to add any others. Her determination and hard work over many years turned that dream a reality. In 2023, Katherine was selected by the European Space Agency to undertake astronaut training out of 22,500 eligible candidates.

During National Science Week, she visited Scienceworks where she spoke to over 800 adults and children who were inspired by her story.

With a background in engineering, physics, and computer programming, she highlighted the fact that the scientific and technological advances required for space travel rely on interdisciplinary science. People from different STEM disciplines working together is key to humanity surviving off world – and we can use the technological advances designed for this purpose to even help us thrive on Earth.



Alison Vaughan highlighted the importance of herbaria as "botanical time capsules". Photograph: Dr Catriona Nguyen-Robertson.

Botanical Time Capsules (Royal Botanic Gardens Victoria)

'Every time you use a botanical name, you are referencing the work of herbaria,' says Alison Vaughan, Manager Collections at the National Herbarium of Victoria.

The National Herbarium of Victoria houses 1.5 million preserved specimens of plants, algae, and fungi. Each specimen is a record of the presence of that plant, algae, or fungi at a location at a particular point in time. Together, they provide a botanical time capsule and a picture of biodiversity through time. This comes particularly in handy during bushfire recovery efforts so that botanists can compare the record for what species have grown where in the past to check whether they are still present, or when studying how species with similar histories have adapted to different environments.

Alison discussed the importance of the herbarium and its historical heroes, including Sir Ferdinand von Mueller, who collected around 25,000 specimens himself and recruited other to collect for him; Alexander Cliff Beauglehole, who collected 90,000 and contributed 18% of the Victorian collection; and Ilma Grace Stone, who collected mosses in tobacco tins and chocolate boxes, and described 25 species.

Astronaut Katherine Bennell-Pegg in conversation with Dr Catriona Nguyen-Robertson at Scienceworks. Photograph: Eugene Hyland/Museums Victoria.

Science on Show (Museums Victoria)

Science on Show showcases some of the rarest and most fascinating species and specimens displayed at Melbourne Museum.

Many marine animals were out on display, including Giant Spider Crabs. When solitary, these crabs are often hard to spot, as algae, sponges and sea squirts settle down on their shells and provide excellent camouflage. However, every year, thousands congregate in Port Phillip Bay ahead of their annual winter moult, making them much easier to spot. They are also easy to spot in resin at the museum.

This country is also home to over 800 lizard species differing in shape and size, each suited to their different habitats.[1] Herpetologist A/Prof Jane Melville highlighted the difference between lizard species that have adapted to differences in their habitat and food sources over millennia. Studying the differences between lizards and other species has been made easier with the ability to CT-scan specimens in museum collections and 3D-print enlarged models of their skulls and other body parts. These new methods help scientists understand how past climates contributed to herpetofauna biodiversity, and what the future of these species may look like.

Raising Rarity Revealed (Royal Botanic Gardens Victoria)

Among all Australian plants, 90% are only found here and nowhere else on Earth.[2] But plants face a variety of threats including weed invasion, rabbit digging and habitat destruction, and climate change. Because of this, over a third of plants in Victoria are listed as threatened.[3]

Royal Botanic Gardens Cranbourne invited people to see behind the scenes of the Raising Rarity program, a community-based outreach program designed to engage the wider community to conserve threatened Victorian plant species.

Participants visited the Royal Botanic Gardens Victoria nursery to learn about the specialist production and propagation techniques used to save Victoria's most threatened plant species. The reliance of many native plants on one single pollinator species to be spread or one fungal species at their roots to germinate, orchids can be quite vulnerable to changes in the ecosystem. Horticulturalists at the Gardens therefore need to consider entire ecosystems when considering how to grow rare plant species.

Participants even took home their own threatened plant species so that they could continue playing their part in the preservation of our precious botanical heritage.

Species Survival Day (Zoos Victoria)

Zoos Victoria is committed to fighting wildlife extinction. They run conservation programs dedicated to the recovery of 27 local threatened species. For several species, their long-term commitment is their only hope of survival. Kyabram Fauna Park homes endangered species with hopes of saving their populations.

Species Survival Day at Kyabram Fauna Park allowed members of the community to get up close and personal with Australia's native animals and learn how to become a conservation hero.

Kyabram Fauna Park is home to two endangered Southern Cassowaries after their previous wildlife park had to close due to bushfires. The Southern Cassowary is a large flightless bird that helps to maintain healthy, diverse rainforests by spreading seeds as it eats and runs. Visitors were invited to bird watch in the Woodlands and Walk-through Aviaries to catch a glimpse of various colourful and feathered friends. It is also a haven for the Spotted-tailed Quoll, away from cat and fox predators and habitat destruction. The Spotted-tailed Quoll Australia's largest carnivorous marsupial. Visitors were encouraged to design their own conservation solutions to help enrich the quolls' zoo habitat and to ensure the safety of their decreasing population in the wild.

REFERENCES:

1. Australian Wildlife Conservancy. (2024, February 10). Australia, land of dragons. www.australianwildlife.org/australia-land-of-dragons
2. Chapman, A.D. (2009). Numbers of Living Species in Australia and the World - Detailed discussion by Group: Plants. Australian Biodiversity Information Services. www.dcceew.gov.au/science-research/abrs/publications/other/numbers-living-species/discussion-plants
3. Commissioner for Environmental Sustainability. (2018). State of the Environment Report 2018. www.ces.vic.gov.au/state-of-reports/state-environment-2018-report

A Mountain Pygmy-Possum at Healesville Sanctuary. Photograph: Zoos Victoria.

Moth Tracker 2024/25

DR MARISSA L. PARROTT
Senior Conservation Biologist, Zoos Victoria

Spring has sprung, and with it we are launching Moth Tracker again!

We need your help in keeping an eye out for Bogong Moths! If you think you've spotted one, upload a photo to Moth Tracker.

Each spring, Mountain Pygmy-possums wake up from hibernation, hungry for nutritious Bogong Moths to eat. Bogong Moths usually fly to the possums' mountain home in the billions, but fewer moths have arrived over the last few years, causing additional stress on the already Critically Endangered Mountain Pygmy-possum. The tiny, but mighty, Bogong Moth was added to the IUCN Endangered species list in 2021 with concerns rising for the long-term survival of this amazing Australian species.

We need your help. If you see a Bogong Moth, upload the photo and location to Zoos Victoria's Moth Tracker. This will help scientists better understand if the moths will make it to the mountains this year.

▶ Learn more: **zoo.org.au/moth-tracker**

Call for Scientific Papers

AVAILABLE ONLINE AT PUBLISH.CSIRO.AU/RS

The Proceedings of the Royal Society of Victoria is our refereed journal, published twice annually by CSIRO Publishing.

The Society invites contributions for the *Proceedings* from authors across the various disciplines of biological, physical and earth sciences, including multidisciplinary research, and on issues concerning technology and the applied sciences.

Contributions on topics that are relevant to Victoria and the south-eastern Australian region are encouraged. The journal also publishes Special Issues and themed collections of papers commissioned by the Council of the Royal Society of Victoria. It is published online in May and November, with two issues constituting a volume.

The *Proceedings* is one of Australia's oldest and longest-running science journals, a terrific platform for establishing an individual research presence, grouping papers derived from symposia on specific subjects, or simply joining a distinguished tradition of science published in or about our region that stretches back to the 1850s.

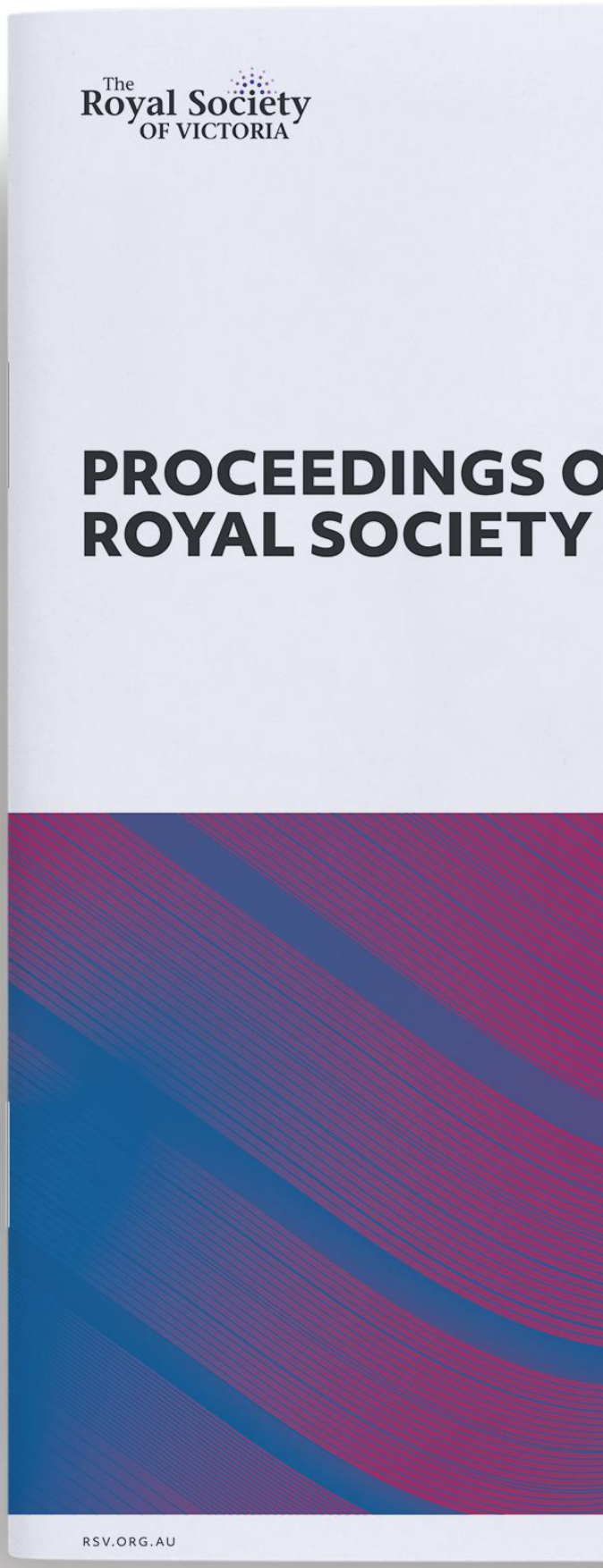
The journal began in 1855 as an irregular publication under the title *Transactions of the Philosophical Society of Victoria,* with the present name adopted in 1889. Since then, volumes of the journal have been published annually, often across one or more parts.

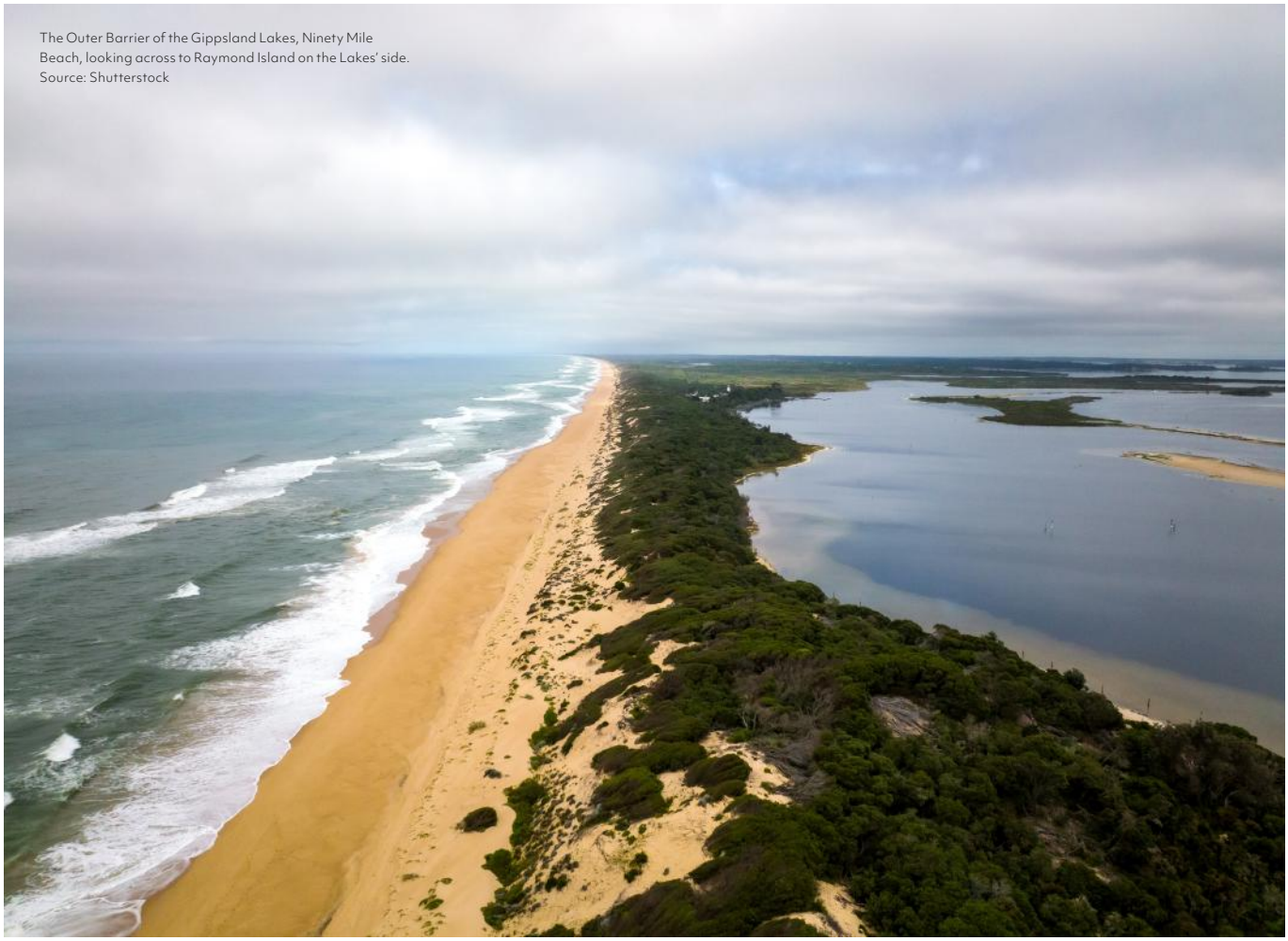
The online content published by CSIRO Publishing extends back to Volume 118, 2006, and is available at **publish.csiro.au/rs**.

All volumes of the *Proceedings* and its predecessors from 1854 to 2006 are also available free online at **biodiversitylibrary.org/creator/6984**.

Submissions

Those interested in submitting papers should review the Author Instructions at **publish.csiro.au/rs/forauthors/AuthorInstructions**. Manuscript submissions for the Proceedings are now made using the ScholarOne platform. Any enquiries regarding submission can be made to **editor@rsv.org.au**





The Outer Barrier of the Gippsland Lakes, Ninety Mile Beach, looking across to Raymond Island on the Lakes' side. Source: Shutterstock

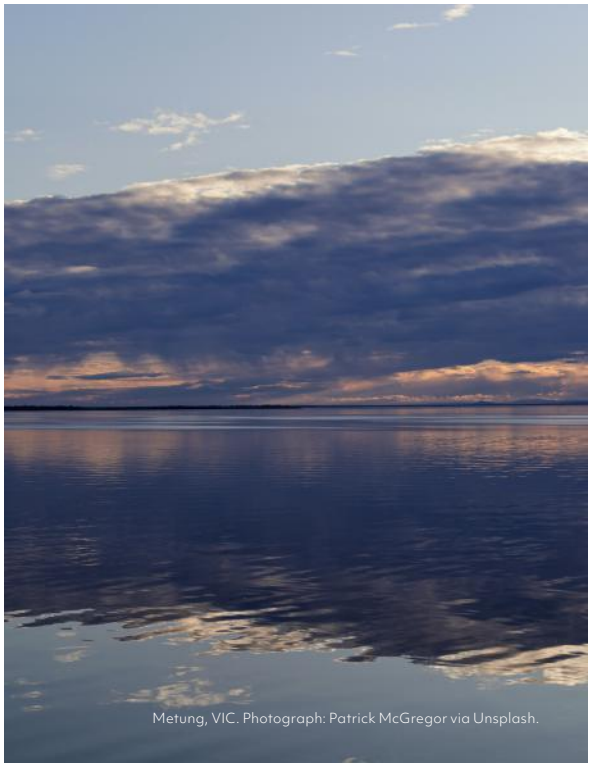
The Future of the Gippsland Lakes

PROCEEDINGS OF THE ROYAL SOCIETY OF VICTORIA, VOLUME 136

The first papers from Volume 136 of the *Proceedings of the Royal Society of Victoria* are now available online, open access from CSIRO Publishing, hosted at **publish.csiro.au/rs/collection/12070**. This volume is the first to be released under CSIRO Publishing's new 'publish-as-you-go' model, progressively collecting the volume over the course of the year.

This collection on the Gippsland Lakes compiles papers commissioned following the roundtable held at the Royal Society of Victoria on 26 May 2023, involving research expertise along with First Nations (Gunaikurnai) representation. It summarises the geomorphological character of the Lakes system, the current state of estuarine health, and anticipates the impacts of intensified human activities, a drying regional climate and rising sea levels on the interaction of the marine and freshwater ecological conditions.

The Society's report from the roundtable, titled 'Securing the Future of the Gippsland Lakes,' is also available at **rsv.org.au/gippsland-lakes**.



Metung, VIC. Photograph: Patrick McGregor via Unsplash.

Papers from Volume 136

Adaptive governance of large, complex ecosystems – such as the Gippsland Lakes

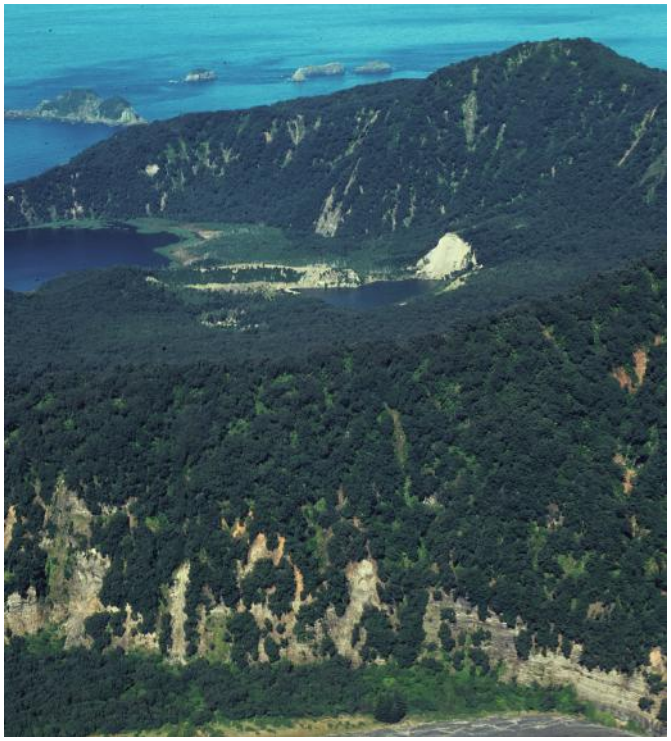
BY MICHAEL SPENCER AND JASON ALEXANDRA

The adaptive governance of large complex ecosystems is increasingly recognised as a global challenge. Traditional governance models are proving inadequate, given the compounding and cascading pressures that result from combinations of climate, geophysical, land use, and biodiversity changes. It is argued that institutions become locked-in to ways of thinking, and acting in a manner that constrains their ability to adapt to change.

In this paper, we outline the challenges to traditional research and governance models through an examination of the Gippsland Lakes in Victoria. We propose that options for more adaptive models are explored through deliberative processes. We also argue that governance during periods of rapid change needs to be adaptive and flexible, integrative rather than siloed, responsive, capable of transformative change and inclusive of stakeholder voices.

► You can read this open access paper in the *Proceedings of the Royal Society of Victoria* via CSIRO Publishing at **publish.csiro.au/rs/fulltext/RS24003**.

Looking towards Eagle Point from the Silt Wharves. Photograph: Peter Kerran via flickr (CC BY 2.0).



Raoul Island, the largest of the Kermadec Islands. Photograph: Copyright GNS Science/GeoNet (CC BY 3.0 NZ)

A new species of Thecidellina (*Brachiopoda*) from the Kermadec Islands, southwest Pacific Ocean

BY JEFFREY H. ROBINSON

This paper describes a new species of very small thecideid brachiopod from the Kermadec Islands, located in the southwest Pacific Ocean. The species, *Thecidellina lueteri*, is herein described, increasing the number of extant species in this genus to 13 – six of them occurring in the Pacific.

The paper includes a series of images showing the development of the important structures in the dorsal valve from a tiny juvenile to an adult, for both this new species, and also for a second species from Lord Howe Rise. These developmental series are important as thecideid brachiopods go through a lot of change during their development.

► You can read this open access paper in the *Proceedings of the Royal Society of Victoria* via CSIRO Publishing at **publish.csiro.au/rs/fulltext/RS24005**.

Current Government Consultations of Interest to Victoria's Science Community

*Projects open for consultation from **engage.vic.gov.au/project***

Brandon Griggs via Unsplash

CONSULTATION CLOSES 14 OCTOBER 2024

SEC Energy Pty Ltd - electricity retail licence application

The Essential Services Commission is reviewing an electricity retail licence application from SEC Energy Pty Ltd and wants to hear from you.

engage.vic.gov.au/sec-energy-pty-ltd-application-for-an-electricity-retail-licence

Aaron Jones via Unsplash

CONSULTATION CLOSES 16 OCTOBER 2024

Heytesbury Underground Gas Storage (HUGS) Project

Lochard Energy (Iona Operations) Pty Ltd proposes to construct and operate a 5.3 km pipeline near Timboon and Port Campbell in western Victoria to transport natural gas or hydrogen.

engage.vic.gov.au/hugs

Neroli Wesley via Unsplash

CONSULTATION CLOSES 14 OCTOBER 2024

EPA's Statement of Regulatory Intent on Climate Change

Share your thoughts and opinions on Environment Protection Authority's Statement of regulatory intent on climate change.

engage.vic.gov.au/epas-statement-of-regulatory-intent-on-the-causes-and-consequences-of-climate-change

Alexander Grey via Unsplash

CONSULTATION CLOSES 17 NOVEMBER 2024

Maternal and Child Health Services

The Department of Health wants to hear from parents, carers, and families on how your Maternal and Child Health Service can better support your family and your child's needs.

engage.vic.gov.au/have-your-say-on-maternal-and-child-health-services

Submission Guidelines

Pitch it to us!

Have an idea for an article?
We want to hear from you!

Briefly outline your key message, why it should be shared in *Science Victoria*, and the proposed article type. Pitches can be submitted at any time, but check submission deadlines if you're interested in publishing in a particular edition.

All pieces will be reviewed prior to publishing, and may be edited for length and clarity (although we will not alter the message or context of your work).

Send pitches and any questions to **editor@ScienceVictoria.org.au**.

We welcome your pitches relating to current scientific research in Victoria, recent scientific discoveries, social and policy issues, technical innovations, and overviews of impactful research.

Science Victoria's articles are written in plain, non-academic language, and thoroughly referenced (see: References).This is not a platform for scientific journal articles or media pieces. For more information on what we're looking for, see below.

Style Guide

All pieces should have readability in mind. A good litmus test is knowing that most people have read a piece or been to a presentation that managed to make the most interesting topics incredibly boring and/or confusing. This is what you want to avoid.

A general guide for readability is that it should be understood by an educated 16-year-old – or ask a friend or family member to proofread!

Feature Articles

Recommended length: 600 - 1,800 words

Feature articles are more in-depth pieces on a specific topic related to STEMM. A key aspect of feature articles is the narrative – this isn't a journal article, so think about the story that your article is trying to tell.

Avoid using jargon, as it will quickly alienate anyone who isn't an expert in that field. Explaining one or two otherwise irreplaceable terms is fine.

Use of sub-headings and figures to break up longer pieces is strongly encouraged.

Not quite sure about the tone for your piece? Have a look at articles published in previous editions of *Science Victoria*, or in other scientific publications for a general audience, like *The Conversation, Cosmos, New Scientist, or Scientific American.*

Guidelines for Authors

Opinion Articles

Recommended length: 600 - 1,800 words

In contrast to a feature article, an opinion piece conveys your informed opinion on, or experiences with, a particular topic. Clearly state your argument, outlining the details of the problem you are addressing, and build to a strong conclusion.

For greatest impact, your choice of topic should be one that is broadly relevant to STEMM-related fields in Victoria. Examples of possible topics include how to address a climate-change related problem in Victoria; successes and failures common to STEMM engagement initiatives; ethical problems related to scientific projects or careers in STEMM; your experiences of a career in STEMM and thoughts on how to better support the next generation of researchers; existing STEMM-related studies or approaches that you believe could be applied in Victoria.

We welcome well-informed opinion articles from all authors, particularly from those with significant expertise in a given area. Articles may reference your own work; however, these are not promotional fluff pieces.

Letters

Recommended length: 200 – 1,000 words

Letters have minimal restrictions on style, structure, or subject matter. You are encouraged to submit your thoughts/questions/comments that broadly relate to STEMM in Victoria. Potential subject areas include responses to articles in previous editions of *Science Victoria*, seminars at scientific events, science-related issues and policies, or topics you'd like to see in future editions.

Letters are also the best format to share current or recent news relating to science, with an emphasis on science in Victoria or news that impacts Victoria's scientific community. News could relate to funding announcements/grant outcomes, new STEMM-related projects, high-impact publications relevant to Victoria, successes of Victorian scientists, or relevant STEMM-related policy news.

Where a specific question is asked, we will try to have the appropriate person respond to your letter.

What I've Been Reading

Recommended length: 600 - 1,800 words

This is a column for you to tell us about a book broadly relating to STEMM that you've read. These pieces typically include a summary of the book and its ideas, as well as your interpretations or conclusions. Possible questions to consider: Do you think the author was correct in any assumptions? Was the author's style of writing approachable? Did they do the subject matter justice? Who would you recommend this particular book to? What did it mean to you? What did you learn?

Images and Figures

Images are strongly encouraged, however please only provide files that are either completely original, in the Public Domain, or covered by an appropriate Creative Commons license. Images must include details of the source, license, and any relevant descriptions.

If suitable images are not provided, we may include relevant Public Domain/Creative Commons images.

All images must be of sufficient size and quality – as a rough guide, aim for >1.3 MB in file size.

References

Please reference primary sources/journal articles for any non-trivial scientific claims, or for publications that prompted your writing of the article. If references aren't provided, we will request them for specific statements.

References for all articles should use a modified APA 7th edition format: reference list in author-year format, with numbered in-text citations. Refer to articles in previous editions for examples. Please do not submit pieces that use MS Word's References/Footnote/Endnotes feature, as it forces us to manually re-write your references.

Submission Deadlines

MARCH 2024	DUE DATE
Victoria's Fauna	*16 February*

Everything *Animalia* in Victoria, particularly native fauna.

APRIL 2024	DUE DATE
The Four Planetary Crises	*15 March*

Biodiversity Loss, Climate Change, Pollution & Waste, and The Rise of Misinformation

MAY 2024	DUE DATE
Accessibility & Inclusion in STEMM	*19 April*

Supporting the education, employment, and engagement of everyone in STEMM.

JUNE 2024	DUE DATE
Victoria & Climate Change	*17 May*

The impacts of, research on, and responses to climate change in Victoria.

JULY 2024	DUE DATE
Building Scientific Competency	*14 June*

Empowering individuals and communities to understand the scientific method.

AUGUST 2024	DUE DATE
STEMM Throughout Victoria	*19 July*

The opportunities for learning and engaging with STEMM across the state.

SEPTEMBER 2024	DUE DATE
Pollution in Victoria	*16 August*

The different pollutants, sources, impacts, and responses required.

OCTOBER 2024	DUE DATE
Victoria's Ecosystems	*13 September*

The many and varied ecological niches across Victoria

NOVEMBER 2024	DUE DATE
Science & Policy	*18 October*

From lab bench to front bench: how scientific understanding can positively influence policy.

DECEMBER 2023	DUE DATE
Science & Business	*15 November*

Creating a sustainable industry, start-ups, med-tech, patents, and ethics.

Hold Your Next Event at the Royal Society of Victoria

The RSV engages communities with scientific knowledge through aligned partnerships, events, festivals, conferences, and education programs.

Services Available

We also provide a number of services to ensure your event is a success. Some of the services we provide are:

- Event management
- Meeting venues
- Grants and awards administration
- Social media campaign management
- Broadcasting and video production
- Recruitment of scientific panels
- Convening community engagement and deliberation processes where scientific work contributes to social, environmental, and economic impacts and benefits.

The Facilities

The RSV's facilities are available for hire to organisations, companies, or private groups.

Audio-visual and seminar equipment is available for use, including videoconferencing facilities for hybrid Zoom/MS Teams meetings.

There is a commercial kitchen on the ground floor, suitable for your own use or by a caterer. Limited parking is available on-site, and a commercial parking operator is adjacent on La Trobe Street.

▶ Take a Virtual Tour of the building at: **matterport.com/discover/space/royal-society-victoria**

▶ Email rsv@rsv.org.au to discuss your needs and ideas!

The Burke and Wills Room

The beginning and end of the ill-fated Victorian Exploring Expedition of 1860-61 is a beautiful, multi-function space with an adjoining kitchen, suitable for a range of events.

SUITABLE FOR

Workshops, roundtables, luncheons, dinners, seminars, and functions.

CAPACITY

Workshops	*≤30 people*
Dinners	*≤60 people*
Catered Functions	*≤80 people*

The Ellery Lecture Theatre

First-floor lecture theatre, with raked seating, speaker's podium, and audio/visual equipment. Perfect for lectures, presentations, and conferences.

SUITABLE FOR

Presentations, seminars, lectures.

CAPACITY

Any Booking	*≤90 people*

The Millis Room

A versatile room on the ground floor, with views of the Carlton Gardens. Suitable for smaller meetings, group/individual work, or seminars.

SUITABLE FOR	CAPACITY	
Meetings, group/individual workspace, and seminars.	*Any Booking*	*≤15 people*

The Cudmore Library

A picturesque room with videoconferencing and projection equipment. Great for larger meetings and seminars, with in-person or hybrid attendees.

SUITABLE FOR	CAPACITY	
Meetings, seminars, and videoconferencing.	*Any Booking*	*≤15 people*

The Von Mueller Room

A light-filled room on the first floor, perfect for smaller meetings and seminars, or group/individual work.

SUITABLE FOR	CAPACITY	
Meetings, seminars, and videoconferencing.	*Any Booking*	*≤15 people*

Support Victoria's Science Society in 2024 and help us to engage individuals and communities with STEMM

WHO WE ARE

Founded in 1854, the Royal Society of Victoria (RSV) is our state's science society.

We are a membership based, non-government organisation, advocating for the importance of science, technology, innovation, and building the skills for Victoria's future industries, governments, community leaders, and research superstars.

WHAT WE DO

We manage the Inspiring Australia program in Victoria (inspiringvictoria.org.au), meaningfully engaging communities with science.

We encourage, profile, and celebrate the achievements of Victorian scientists through public lectures, awards, and prizes, which are supported by the donations and bequests to the RSV Science Foundation.

WHERE YOUR DONATIONS GO

Your donations allow us to continue the work we have been doing for Victoria for more than 160 years. This includes hosting organising/hosting/running STEMM events, running a public lecture series (in-person and online), producing the magazine *Science Victoria*, celebrating Victorian scientists through awards and prizes, publishing Victorian science in our academic journal (the Proceedings of the Royal Society of Victoria), and empowering the next generation of scientists.

HOW TO SUPPORT

We also support a number of smaller organisations, which are listed at **rsv.org.au**.

You can donate online now at **rsv.org.au/support-the-rsv**, or alternatively contact us at **rsv@rsv.org.au** for information about other payment methods.

Become a Member of the RSV

We bring together an independent community of science practitioners, educators, industrialists, and enthusiasts to promote an understanding and utilisation of scientific knowledge for the benefit of the state of Victoria.

	STUDENT	FULL	ORG.	SCHOOL	AFFILIATE
	$40 PER YEAR	$120 PER YEAR	$1000 PER YEAR	$1000 PER YEAR	$500 PER YEAR
Special Membership rates at RSV and affiliate events.	✓	✓			
Networking opportunities – national and local.	✓	✓	✓	✓	✓
Recognition of membership through use of post-nominal affix	MRSV	MRSV			
Science Victoria Digital Edition (Printed copy available for an additional fee).	✓	✓	✓	✓	✓
Free monthly printed copies of *Science Victoria* for school libraries.				✓	
Recognition of achievements through awards programs.	✓	✓			
Discounted advertising in *Science Victoria*			✓	✓	✓
Discounted facility hire at 8 La Trobe Street, Melbourne.			✓	✓	✓
Discounted membership rate for eligible full-time students.	✓				
Discount on purchases from CSIRO Publishing	✓	✓			
'Schools Supporting Schools' Membership Program*				✓	
Listing of membership on the RSV.org.au website.			✓	✓	✓

Individual Members

MR XAVIER JAMES MADDERN
PhD Candidate, The University of Melbourne

MISS BUDDHILA WICKRAMASINGHE
PhD Candidate, La Trobe University

MR SATHEESH KUMAR
PhD Candidate, The University of Melbourne

MS LIANA THEODORIDIS
PhD Candidate, La Trobe University

MR VINÍCIUS WERNECK SALAZAR
PhD Candidate, The University of Melbourne

MISS JIYI PANG
PhD Candidate, The University of Melbourne

MISS LEESA LERTSUMITKUL
PhD Candidate, The University of Melbourne

MISS ELIZABETH KLEEMAN
PhD Candidate, The University of Melbourne

MISS SARA TOMEI
PhD Candidate, The University of Melbourne

MR JIASHENG ZHU
PhD Candidate, RMIT University

MS YU-WEN HUANG
PhD Candidate, The University of Melbourne

MISS JESSICA FAIRLEY
PhD Candidate, The University of Melbourne

MS THI LAN DAO
PhD Candidate, The University of Melbourne

DR OULI XIE
PhD Candidate, The University of Melbourne

MS HANNAH MORGAN
PhD Candidate, The University of Melbourne

MR JUSTIN REN
PhD Candidate, The University of Melbourne

MS PAVITHA PARATHAN
PhD Candidate, La Trobe University

MS LEA LEWIN
ESG Manager, Bapcor Pty Ltd

MS SHANNON-KATE ARCHER
Victorian Public Service

How to Join

For more information:
rsv.org.au/how-to-join

* The 'Schools Supporting Schools' membership program allows a school to sponsor the membership of one or more schools at a discounted rate of $750/year, allowing less-resourced schools the same benefits and opportunities of RSV membership.

Science Victoria
The Royal Society of Victoria
Wurundjeri Country
8 La Trobe Street, Melbourne, VIC 3000

View the Digital Edition
Scan the QR Code or go to:
rsv.org.au/news/science-victoria

Science Victoria is printed by Complete Colour who are ISO14001 EMS, ISO9000 QMS, & FSC certified, using Monza Satin FSC 100% recycled paper. Monza Recycled contains 100% recycled fibre and is FSC® Mix Certified, which ensures that pulp is derived from well-managed forests and recycled wood fibre. Monza Recycled is manufactured by an ISO 14001 certified mill.