The Royal Society of Victoria
Promoting science since 1854

SCIENCE VICTORIA

NEWS FROM THE ROYAL SOCIETY OF VICTORIA

DECEMBER 2021

THE OFFICIAL NEWSLETTER OF RSV

In this issue

ISSUE 12

News and notices

New RSV Members

Ms Victoria Jaeger

Retired

Mr Stephen Braida

Managing Director - Intelligent BI Ltd

Dr Sina Babazadeh

Orthopaedic Surgeon - St Vincent's Hospital

Dr Ray Boyapati

Gastroenterologist - Monash Health

Unless Members request a ballot, these will be considered by Council and, if elected, will be confirmed at the next Ordinary Meeting of the Royal Society of Victoria.

The Prime Minister of India, Shri Narendra Modi, at COP 26 in Glasgow, 1 November 2021

From the President: What do you think?

In recent months I have attended a number of workshops at the Victorian Chamber of Commerce and Industry's Victoria Summit. Unfortunately, the outcomes of the Summit process so far fail to address the two, global existential crises that all human societies currently face:

1. Anthropogenic global heating and measures to rapidly mitigate it ('Net zero' by 2050? 2030?)
2. The collapse of nature and the need to reinvest in biodiversity to fundamentally support our economic system.

These were the two focal points and two of the highest-level outcomes of the UNFCCC COP 26, held in Glasgow, Scotland, and the Convention on Biological Diversity, COP 15, held in Kunming, China, over the course of October and November this year.[1,2]

These outcomes call for transformational change; a system-wide reorganisation, not 'business as usual with a few tweaks.' We cannot expect to achieve the necessary results for the future of all Victorians with incremental approaches to change; yet transformation change requires a concerted effort by almost everyone in our society, which means a comprehensive, shared understanding of the catalysts for change and a roadmap for collective achievement.

Accordingly, the Royal Society's Council seeks to sharpen the RSV's role in promoting science-based decision-making in Victoria with the wider community, government and the corporate sector. To this end, we want to ensure our membership has an opportunity to contribute to the establishment of an agreed position on important issues and support new programs designed to engage and empower Victorian communities in plotting their course for the future.

We are now considering a range of topics and a robust process for developing RSV 'Position Papers,' designed to provide a consensus view on current issues that the Society's membership can champion and will position our organisation as a science-based critical resource, available to the community, government and industry sectors alike.

Mr Rob Gell AM, RSV President

SCIENCE VICTORIA

Monthly newsletter of the RSV

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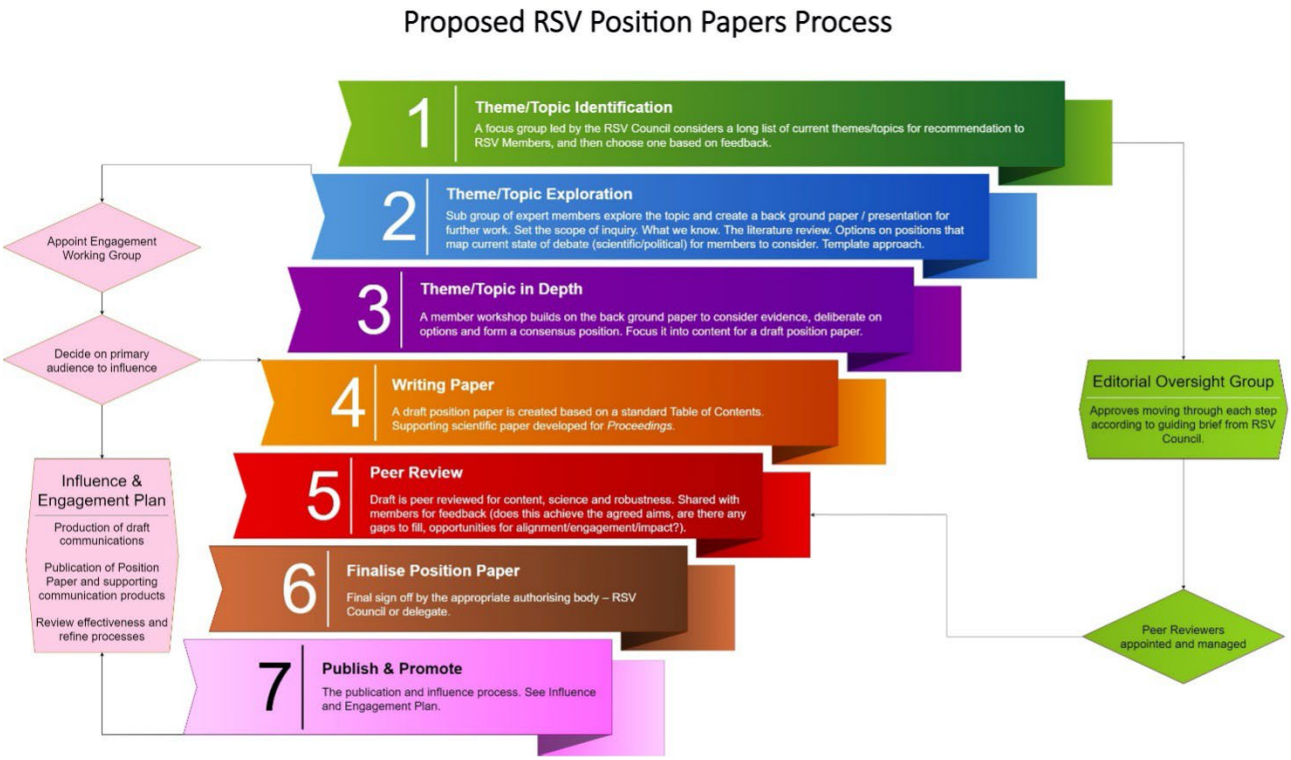
1 https://ukcop26.org/
2 https://www.cbd.int/conferences/2021-2022



The themes and issues under consideration are derived from a recent focus group meeting and are canvassed below. We would welcome your thoughts and contributions on these; an email will be with RSV members this week from our CEO directing you to a short survey instrument designed to help us collate the many responses we hope to receive, but I also welcome "Letters to the President" for publication in future editions of Science Victoria – you can send these through to me at *president@rsv.org.au*. While there is no assurance that we will publish everything I receive, and we reserve the right to edit letters for brevity, we'll certainly publish anything that stimulates and progresses a reasoned, fruitful discussion.

BIODIVERSITY

Long 'out of sight, out of mind' in Australia's policy response, attention has finally been paid to the collapse of nature at both the Biological Diversity COP15 and the climate COP26 in Glasgow.

The *International Business Times* reported in *Biodiversity Loss: The Overlooked Crisis*[3] that the Glasgow Leaders' Declaration on Forests and Land Use, announced within 48 hours of the conference getting underway, came as both a welcome surprise and a great relief. The commitment of 105 signatories is to work together to end and reverse deforestation by 2030.The Society is considering positions on:

- the potential to recover Victoria's biological diversity - what will it take?
- the establishment of a new Victorian National Park in the Central Highlands[4,5]
- the need for an independent, specialist biodiversity agency
- control of invasive species

POPULATION

At the inauguration of new RSV Fellows earlier this year there was discussion about whether or not a valuable exercise might be to ask our Fellows to tackle a 'wicked problem', each from their own scientific perspective. A topic that was immediately proposed was population.

The Society is considering questions such as:

- What makes a liveable city?
- How much can Victoria grow; how big can we get?
- What will it take to make Victoria' supply chains sustainable and secure?

3 https://www.ibtimes.sg/biodiversity-loss-overlooked-crisis-61327
4 https://www.patagonia.com.au/products/the-great-forest-david-lindenmayer-bkub01-zzz
5 https://rsv.org.au/action-needed-to-ensure-the-recovery-of-the-leadbeaters-possum/

CLIMATE IMPACTS AND TECHNOLOGICAL FIXES

Our capacity to adapt to the impacts of climate change – sea level rise, storms and coastal erosion, flooding, and bushfire – will continue to be tested in the years to come. We must continue to mitigate the worst effects while preparing for the change that is 'locked in.'

Carbon Capture and Storage (CCS) is being included as a new technology for reducing atmospheric carbon dioxide to mitigate anthropogenic global warming. It is a critical policy component now Australia's 'net zero' by 2050 target.

The Society is considering questions such as:

- Does Carbon Capture and Storage work?
- How do we protect ourselves from bushfire smoke inundation?[6]
- Fire: control burning; 'fuel breaks[7]'and the appropriate use of indigenous fire knowledge.

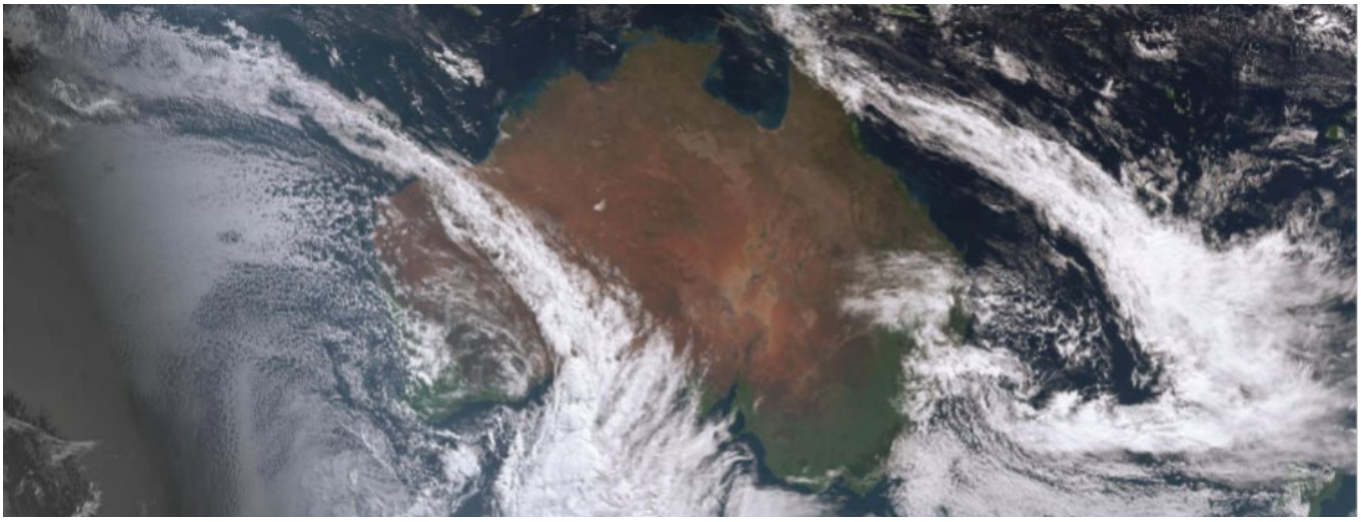
OTHER ISSUES FOR CONSIDERATION:

There are other critical issues for us to consider about the real value of science to our community. For example:

- The pandemic has made stark the "science vs belief" dichotomy in many quarters, which can be informed by the professional practice of clear science communication and its effective utility by governments.
- The value of investment in research was recently discussed in *The Conversation*[8] and refers to the CSIRO's working paper on investment in innovation[9] as key contributor to Australia's economic growth and prosperity.
- It will also be important to consider contributions to Victorian Government engagement programs and discussions on subjects from the Gas Substitution Roadmap[10] to Victoria's Marine Pest Policy[11] or sustainable water strategies[12].

The scientific and critical thinking capability of our membership, paired with the urgency of providing Victorian communities with a renewed confidence in science-based decision-making, provides a real opportunity for the Royal Society of Victoria to utilise its independence and build a strong reputation by fulfilling its foundational objective in promoting and advancing science.

6 https://www.ecowatch.com/wildfire-smoke-covid-deaths-2654682194.html
7 https://engage.vic.gov.au/strategic-fuel-breaks
8 https://theconversation.com/every-dollar-invested-in-research-and-development-creates-3-50-in-benefits-for-australia-says-new-csiro-analysis-172300
9 https://www.csiro.au/work-with-us/services/consultancy-strategic-advice-services/CSIRO-futures/Futures-reports/Quantifying-Australias-returns-to-innovation
10 https://www.premier.vic.gov.au/have-your-say-victorias-gas-substitution-roadmap
11 https://engage.vic.gov.au/victoria-invasive-marine-pests
12 https://engage.vic.gov.au/central-and-gippsland-region-sustainable-water-strategy



2021 YSRP Prize Winner for the Earth Sciences

Featuring: Ms Kimberley Reid, School of Geography, Earth & Atmospheric Science, The University of Melbourne

Research topic: The Impacts of Atmospheric Rivers over Australia and New Zealand

Supervisor: Dr Andrew King, The University of Melbourne

At a young age, Kimberley became interested in climate science after the realisation of little interest being shown in Australian politics with the scientific evidence akin to climate change. After gaining a Bachelor of Science majoring in Climate and Weather and a Masters in Science both from The University of Melbourne, she decided to further her research at the university and embarked on a PhD on the topic of extreme rainfall, with emphasis on the understanding of behaviour associated with Atmospheric Rivers (AR)s across Australia and New Zealand. She decided to incorporate a practical element as well, with the use of extreme rainfall instead of conventional systems such as thunderstorms to improve how to predict future natural hazards likely to happen up to six weeks in advance.

Found globally, ARs are one of the major systems that allow water in the atmosphere to travel around the planet. Considered the highways of the Earth, they have the capacity to shift 90% of the water vapour between the equator and the poles. Because they cart so much water, when they come into contact with mountains or intermingle with cold fronts, they expel some of this moisture, leading to intense rainfall and floods.

> While working on her PhD, Kimberley had the opportunity to discuss her research on Atmospheric Rivers (AR)s with the media in Australia and New Zealand, through radio. In addition, both ABC and Sydney Morning Herald wrote news articles about her work.

Although she is still working on the subseasonal forecasting of Atmospheric Rivers, she hopes that this knowledge can be applied in some form to the Bureau of Meteorology's seasonal forecasting products and assist with their predictions of future flooding incidents.

On completion of her PhD, Kimberley plans to do more postdoctoral work in relation to this field and also incorporating the areas science communication and stakeholder engagement.

Journal article

Reid, K. J., Rosier, S. M., Harrington, L. J., King, A. D., & Lane, T. P. (2021). Extreme rainfall in New Zealand and its association with Atmospheric Rivers. *Environmental Research Letters, 16*(4), 044012. DOI: *10.1088/1748-9326/abeae0*

Image of two Atmospheric Rivers over Australia, August 2020, from the Himawari-8 Satellite. Photo courtesy of Kimberley Reid.

Lauren Bleakley in her laboratory at the Florey Institute of Neuroscience and Mental Health. Photo: Nicole Cleary, News Corp.

2021 YSRP Prize Winner for the Biomedical and Health Sciences

Featuring: Ms Lauren Bleakley, Florey Institute of Neuroscience and Mental Health, The University of Melbourne

Research topic: Cation leak underlies neuronal hyperexcitability in an HCN1 developmental & epileptic encephalopathy

Supervisor: Professor Christopher Reid

After completing a Bachelor of Science (Honours) degree from The University of Melbourne in 2017, majoring in Neuroscience, Lauren decided to undertake a PhD at the Florey Institute of Neuroscience and Mental Health. Her focus was on studying epilepsy as a result of mutations found in the Hyperpolarization Activated Cyclic Nucleotide Gated Potassium Channel 1 (HCN1) Protein Coding gene, responsible for spontaneous heart and brain rhythmic activity. Her project was based on a young girl, Ebony, who had been diagnosed with Developmental Epileptic Encephalopathy (DEE), a severe form of HCN1 epilepsy.

When Ebony was first diagnosed with epilepsy, she underwent genetic testing which found that a mutation in her *HCN1* gene was the cause. After learning of the work that the Florey Institute had conducted in this area through their publications, her family contacted the Institute. With a shared interest from both parties in understanding how *HCN1* mutations cause DEE, the project then started.

Although there is always a degree of uncertainty on whether mouse models can replicate human conditions, Lauren's laboratory was able to achieve this feat, producing the world's first mouse model of *HCN1* epilepsy, the Hcn1^{M294L} knock-in mouse. This mouse model is based on the human HCN1 M305L mutation, which has been found in two patients with epilepsy. Her results showed that Hcn1^{M294L} mice have a similar phenotype to human *HCN1* epilepsy patients, including having seizures and learning difficulties.

Using these mice, she discovered that the *HCN1* mutation makes some neurons too active, and as a consequence, she was able to determine the mechanism of how this mutation causes this hyperactivity, which likely explains (at least in part) why this mutation leads to epilepsy. Furthermore, she also used these mice to test a variety of anti-epileptic medications in order to determine their effects on treating *HCN1* epilepsy patients.

After investigating reviews in published data from other laboratories, she also recognised that many other *HCN1* mutations appeared to have a similar impact as the M305L mutation which in turn, suggested that her results might be relevant for other types of *HCN1* epilepsies as well as those that were caused from this one particular mutation.

Besides providing a glimmer of hope to patients with *HCN1* epilepsy, her research has led to the explanation of how several *HCN1* mutations cause epilepsy, which has then offered details on how to effectively treat this condition. Likewise, her results have the potential to deliver a framework that doctors may be able to use to determine the types of drugs to prescribe to *HCN1* epilepsy patients. Consequently, this would mean that these patients could avoid having to undergo further testing in order to obtain suitable medications.

Lauren plans to continue on to a post-doctorate and is looking forward to focusing on the next stage of her research - the opportunity to design targeted treatments for *HCN1* epilepsy that are able to deliver on effectiveness and contain fewer side-effects than those treatments already on the market.

Journal article

Bleakley, L. E., McKenzie, C. E., Soh, M. S., Forster, I. C., Pinares-Garcia, P., Sedo, A., ... & Reid, C. A. (2021). Cation leak underlies neuronal excitability in an HCN1 developmental and epileptic encephalopathy. *Brain*.
DOI: *10.1093/brain/awab145*

2021 YSRP Prize Winner for the Physical Sciences

Featuring: Mr Mark Vidallon, School of Chemistry, Monash University

Research topic: Smart hybrid micro- and nanomaterials for next generation ultrasound imaging

Supervisor: Associate Professor Rico Tabor, Monash University

After doing both a Bachelor of Science majoring in Chemistry and some initial work with the Smart Functional-Biomaterials group at the University of the Philippines, Mark decided to embark on a PhD at Monash University that centred on colloid research, a multidisciplinary area encompassing the interface of chemistry, biology, and physics.

Mark was also intent to expand his knowledge on the fabrication and characterisation of more challenging and 'dynamic' types of colloidal materials that would be able to cater for various uses in the biomedical field, particularly in ultrasound imaging and theranostics - a form of diagnostic testing employed for selecting targeted therapy.

In order to achieve this, his research centred on the development of new types of gas-containing and gas-generating colloids, in this case, nanoparticles, microbubbles, and emulsions. The existence and production of bubbles from these materials are detectable via diagnostic ultrasound and are ideal release triggers for drug cargo. Using erythrocyte or red blood cell membranes and bioinspired polydopamine, he developed biocompatible colloids with "stealth" surfaces to reduce immune response. Furthermore, he explored polydopamine-based emulsions that could convert infrared light into heat for microbubble activation on demand.

The purpose for utilising red blood cell membranes was because of their "stealth" surfaces as well as to be able to allow patients to have an option between a biocompatible 'universal' contrast agent, made with Type O red cells or a 'personalised' treatment, where the patients' blood could be used for fabricating their own contrast agents.

In terms of the impact of his research efforts, Mark expects that various hybrid materials based on his publications and patent on red blood cell membrane 'bubbles' will be fabricated in the future to provide extended applications in various biomedical applications. For instance, when undergoing non-invasive imaging for diagnosis of diseases, or minimally invasive treatment procedures for many types of prevalent conditions, such as cancers and heart disorders.

Likewise, his work on small- and ultra-small-angle neutron scattering for monitoring the transformation of emulsion droplets into microbubbles is also expected to cause other researchers to apply these techniques on other types of dynamic or transforming colloidal systems, which are being studied in a range of areas.

After completing his thesis, Mark plans to do a postdoctorate or work in industry research in this field. Consequently, he intends to either apply his proficiency in colloid synthesis, ultrasound contrast agents and drug delivery systems to develop novel materials for various applications or draw on his experience with advanced colloid and material characterisation techniques to study other different systems of interest.

Journal Articles

Vidallon, M. L. P., Giles, L. W., Pottage, M. J., Butler, C. S., Crawford, S. A., Bishop, A. I., ... & Teo, B. M. (2021). Tracking the heat-triggered phase change of polydopamine-shelled, perfluorocarbon emulsion droplets into microbubbles using neutron scattering. Journal of Colloid and Interface Science. DOI: *10.1016/j.jcis.2021.08.162*

Vidallon, M. L. P., Giles, L. W., Crawford, S., Bishop, A. I., Tabor, R. F., de Campo, L., & Teo, B. M. (2021). Exploring the transition of polydopamine-shelled perfluorohexane emulsion droplets into microbubbles using small-and ultra-small-angle neutron scattering. Physical Chemistry Chemical Physics, 23(16), 9843-9850. DOI: *10.1039/D1CP01146D*

Vidallon, M. L. P., Tabor, R. F., Bishop, A. I., & Teo, B. M. (2021). Ultrasound-assisted fabrication of acoustically active, erythrocyte membrane "bubbles". Ultrasonics sonochemistry, 72, 105429. DOI: *10.1039/D1CP01146D*

Vidallon, M. L. P., & Teo, B. M. (2020). Recent developments in biomolecule-based nanoencapsulation systems for antimicrobial delivery and biofilm disruption. Chemical Communications, 56(90), 13907-13917. DOI: *10.1039/D0CC05880G*

Mark's usual workstations and imaging setups. Left: Transmission electron microscope at Monash Centre for Electron Microscopy (MCEM).

2021 YSRP Prize Winner for the Biological (non-human) Sciences

Featuring: Ms Sarah McDonald, School of Biosciences, The University of Melbourne

Research topic: Metal contaminants in urban stormwater: composition, dynamics & potential threat to aquatic species

Supervisor: Dr Katheryn Hassell, RMIT University

Sarah has always been interested in understanding the impacts of human actions on the environment. So, after finishing a Bachelor of Science and doing honours in ecotoxicology at The Centre for Anthropogenic Pollution Impact and Management (CAPIM) at The University of Melbourne, she decided to undertake a PhD to further explore this area.

While her PhD explored various research areas such as aquatic ecology, ecological statistics and environmental chemistry, Sarah's main focus was to investigate the impact of pulsed stormwater runoff that contained a range of pollutants in high concentrations on local aquatic species. In order to do this, she had to recognise the types of pollutants found in stormwater runoff and their concentrations. A major part involoved observing the effects of stormwater composition changes in terms of type and pollutant concentration during a storm. After collating this data, Sarah was able to plan laboratory-based studies that exposed the local aquatic species, in this case, the glass shrimp, *Paratya australiensis* and the blue-spot goby, *Pseudogobius sp.* to short-term pulses of the metals in order to recreate stormwater runoff conditions in the lab.

Embedding shrimp in a resin for autoradiography at the ANSTO laboratories. Photo courtesy of Sarah McDonald.

To obtain her data, Sarah chose to conduct and take water sample for metallic cadmium and zinc levels in both these aquatic species at Moonee Ponds Creek since it was provided a good example of a highly degraded waterway system and had a long legacy attached to it, that is to say, the metal contaminants found within the creek have been in this ecosystem for a number of years and are also incapable of decomposition.

The findings from Sarah's research have demonstrated to be invaluable in terms of improving on a previously poor understanding of stormwater pulses in an urban system and the impact these pulses have at an organism level. In addition, her studies can be used on a practical basis to revise current water quality guidelines in these ecosystems to assist both researchers and regulators predict the impact of stormwater runoff.

After completing her PhD, Sarah will commence a research scientist position at the Centre for Tropical Water and Aquatic Ecosystem Research (TropWATER) at James Cook University in Townsville.

Journal Articles

McDonald, S., Cresswell, T. and Hassell, K. (2020). Bioaccumulation kinetics of cadmium and zinc in the freshwater decapod crustacean Paratya australiensis following multiple pulse exposures. Science of The Total Environment; 720: 137609. DOI: *https://doi.org/10.1016/j.scitotenv.2020.137609*.

McDonald, S., Hassell, K. and Cresswell, T. (2021). Effect of short-term dietary exposure on metal assimilation and metallothionein induction in the estuarine fish Pseudogobius sp. Science of The Total Environment; 772: 145042. DOI: *https://doi.org/10.1016/j.scitotenv.2021.145042*.

McDonald, S., Cresswell, T., Hassell, K. and Keough, M. (2021). Experimental design and statistical analysis in aquatic live animal radiotracing studies: A systematic review. Critical Reviews in Environmental Science and Technology: 1-30 DOI: *https://doi.org/10.1080/10643389.2021.1899551*.

McDonald, S., Holland, S., Simpson, S.L., Gadd, J.B., Bennett, W.W., Walker, G., Keough, M.J., Cresswell, T., Hassell, K.L. (2021) Urban stormwater runoff: Metal forms and dynamics in a polluted urban creek system in Melbourne, Australia. Water Research. *In review.*

McDonald, S. (2021) Water quality guidelines for metal contaminants in stormwater runoff: Insights and considerations. Environmental Toxicology and Chemistry. *In review.*

Priya Mohandoss is a member of the RSV, holding a Bachelor of Science and Masters of Journalism, Communications and Media Studies from Monash University.

Events for the month

Bio-remediation: Restoring contaminated Ecosystems, naturally

Thu, 9 Dec 2021

6:30 PM - 8:00 PM

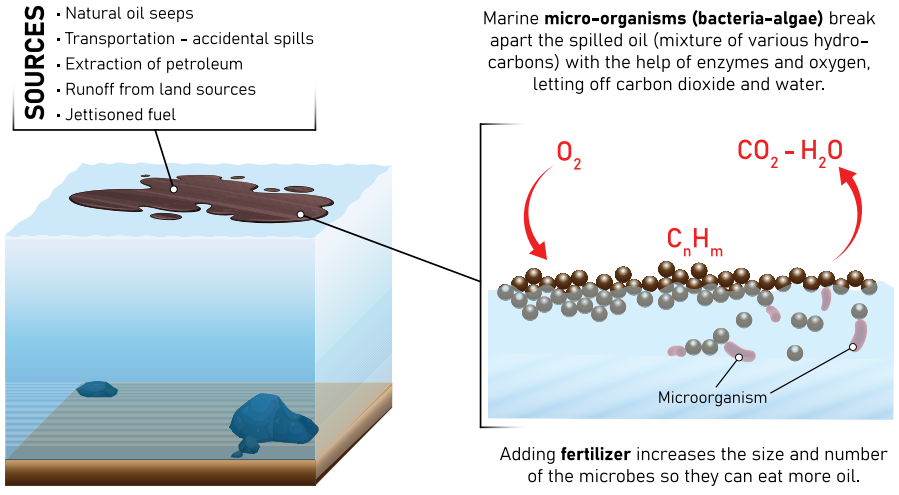
1 x General Registration
A$6.36 incl. A$1.36 Fee & Tax

Sales end on 9 Dec 2021 General Admission for non-members

Nature-harnessing technologies are key to effectively and sustainably restoring contaminated ecosystems, using naturally occurring microorganisms to clean up contamination from oil and other organic pollutants in soils, groundwater and water bodies. The bioremediation process both destroys contaminants and restores an ecosystem's microbiome.

But every local ecosystem is unique when it comes to microbiological communities, so new and innovative approaches are required for each contaminated site.

Understanding the factors that determine the stability and resilience of contaminated ecosystems, and the critical role of that system's natural microbial community, remains one of the frontiers of environmental science. Join Professor Andy Ball to explore how environmental microbiology can be scaled up for impactful and commercially successful applications to contaminated sites all over our highly industrialised world.



About the Speaker

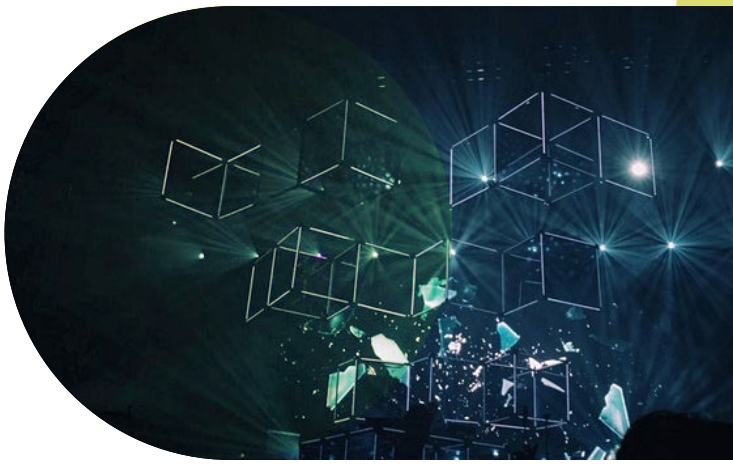
Professor Andrew Ball is the Director of the ARC Training Centre for the Transformation of Australia's Biosolids Resource at RMIT University. With deep expertise in environmental microbiology and biotechnology, Professor Ball was, until recently, the Director of the Centre for Environmental Sustainability and Remediation (EnSuRe) at RMIT.

Andy has headed the Environmental Biotechnology Group, now based at RMIT University (previously based at Essex University and Flinders University), since 1995. He has brought a wealth of research and teaching expertise to Victoria at an international level, particularly in the fields of bioremediation, organic waste treatment, and the environmental fate of organic pollutants. His contributions to his field and to the research community in Victoria were recognised this year with the award of the Royal Society of Victoria's Medal for Excellence in Scientific Research in Category I: Biological Sciences.

Tickets are available *here* to participate in the webinar via Zoom and/or Eventbrite. RSV Members are prompted to enter their promotional code to access a member's ticket. Alternatively, you can watch along via *Facebook Live* at the appointed time without buying a ticket.

Events for the month

AI, VR & EdTech: How Technology is Transforming Education



Tue, 14 Dec 2021

2:30 PM - 3:30 PM

Free

From Augmented Reality to the Metaverse, we are rapidly shifting towards a technologically supercharged world. So how can we leverage this shifting terrain to make learning more exciting and accessible than ever? Join our panel conversation on the exciting potential revealing itself at the intersection of education and emerging technology.

We'll cover:

- How can technology engage students in new and exciting ways?
- Does EdTech help students learn more effectively?
- How did COVID thrust us into new, virtual ways of working and learning?
- What are some of the concerns around emerging technology – how can we circumvent these issues?
- How can technologically enhanced modes of delivery make education more accessible to people of all abilities and backgrounds?
- Where can we start? What are some easy ways to give the classroom a digital makeover? What are some of the tools and software that can be used by absolutely anyone?

Lisa Kerr, Program Manager of GM Vice

GM Vice is a Virtual Reality platform in which students can explore different industries in a 360-degree view, interacting with different touchpoints along the way. Complete with an assistive chatbot, GM Vice was developed as an immersive way for students to explore different career options.

Dr Jo Blannin, Senior Lecturer, Digital Transformations, Monash University

As a sought-after international leader in digital pedagogies and STEM education, Dr Blannin offers a 20+ year career in educational innovation and change leadership. Her previous roles include leadership positions in schools, education systems, banking, business, outdoor education and private consultancy.

Dave Burton, CEO of Goldfields LLEN

While the pandemic meant that many students missed out on excursions and tours, Goldfields LLEN has connected primary aged students with the opportunity to explore virtual spaces as if they were there physically, through a spatial data platform.

Dr Sophia Frentz, Data Consultant, Eliiza

Sophia has a PhD in Genetics and a large number of opinions on the intersections between science, technology, and society. They are currently a Data Consultant at Eliiza and a Councillor of the Royal Society of Victoria.

Graeme Wiggins, Director, Bendigo Tech School

The Bendigo Tech school delivers innovative learning programs that offer engaging experiences to enhance STEAM education. The school is currently offering short programs for students in areas such as AR, wearable technologies, flat-pack housing and VR. Bendigo Tech school is also hosting a Girls in STEAM Electric Car Project. This is an initiative in which a group of 25 girls from years 7-10 are working together to convert an old range rover into an electric vehicle.

The discussion will be facilitated by Mike Flattley, CEO of the Royal Society of Victoria.

Presented by the Victorian Local Learning and Employment Networks in partnership with the Royal Society of Victoria.

Inspiring Victoria

SCIENCE WEEK VICTORIAN SEED GRANTS

National Science Week Victoria again offers a *Seed Grant* scheme of amounts up to $1000 excluding GST to assist Libraries, organisations and individuals who would like to present a public event during National Science Week, August 2022. Applications opened 1 December 2021 and close on Friday 11 February 2022 12noon. Get your best ideas and submit them NOW! ***https://inspiringvictoria.org.au/programs/national-science-week-victoria/grants/***

ACCLIMATISE: a message about change to inspire change

As we approach the end of the year, I like to look back on what I have learned. Climate change was at the forefront of everyone's mind early in 2020 following the 2019-2020 bushfires. But once COVID-19 breached the Australian borders, public attention turned towards the pandemic instead - and rightly so, but it did mean that climate change dropped for many as a priority.

This year, Inspiring Victoria and the Royal Society of Victoria presented ACCLIMATISE, hosted several lectures, and supported community outreach activities around the themes of climate change, adaptability, and sustainability.

As Professor Will Steffen pointed out during two presentations this year, the *Anthropocene is here*. Earth's systems are changing like never before – to the point where geologists have defined a new epoch of time and named it after the cause: human activity.

But, if I've learned anything, it's that it is not too late to change the trajectory of climate change. Climate scientists make predictions about average global temperatures, sea levels, etc. and all of their graphs have multiple paths, knowing that the extent of the damage to Earth is dependent on us and whether we do anything about it.

'The climate will continue to change if we do not change,' says Senior Climatologist, Dr Lynette Bettio as she delivered the State of the *Climate 2020 Report*.

The average global temperature continues to climb
The environment changes in very little time
Ecosystems are altered, animals lose habitat
We have an increasing sense of dread as we watch the thermostat
Less rain, more heat, and weather events are more extreme
Looking at the IPCC report, doom & gloomy it will seem
But the ACCLIMATISE events have given us hope
With the great work people are doing, Earth just might cope
More droughts and bushfires, temperatures rise
To protect the planet, we need to ACCLIMATISE

I wrote this choral piece to highlight environmental changes that are already happening so that it might spark change among people. It touches on the melting ice sheets of Antarctica, the burning Australian bush, and shifting coastlines that impact coastal towns.

For these three places, it's certainly not all bad news. There are many incredible scientists working towards solutions. They just need more support to put their ideas into action.

Professor Patrick Baker is studying how to make Australian forests more *resilient to bush fires*. Ecologists like Professor Brendan Wintle advocate for funds to support conservation programs that fight the *extinction crisis*. A/Prof David Kennedy's 2021 Howitt Lecture on *coastal resilience* demonstrated how sands can shift to push back against the waves.

So let's get the message out there!

I am so grateful to Mike Flattley for his support of this choral project (and his belief that I could compose a choral piece at all), to all the singers (most are from the Melbourne Symphony Orchestra Chorus and others are friends who I managed to persuade), and to Robert Cross for working his magic to compile everyone's videos into a beautiful song. I hope that you enjoy the music and that it encourages you to think about change.

https://youtu.be/MQhfEL1eC7E

Watch/Listen on YouTube now

Catriona Nguyen-Robertson,
RSV Science Communication Officer

Transactions

Pine cones

As December dawns upon us, it is time to adorn our surroundings with ornaments that bring some festive cheer. Whether big or small and coated with some sparkle or tinted in white, pine cones are a natural resource that can be used to fit into any Christmas décor such wreaths, trees, garlands, candles or centrepieces. While they are associated with Christmas, pine cones also play an important part in nature and symbolism.

A touch of Christmas magic. Photo courtesy of Priya Mohandoss

by Priya Mohandoss MRSV

Although all conifer trees produce cones, pine cones only originate from pine trees and are classified under an ancient group of plants known as gymnosperms. This species is one of the oldest species of living organisms found on the Earth, dating back to nearly 153 million years ago.

Since they are a non-flowering species, gymnosperms only produce naked seeds. Being wooden structures encompassed with a mass of scales, pine cones are equipped to close their scales in order to stockpile and protect and the seeds they hold inside from the cold, wind, ice and other animals that may forage them as a source of food. During the warmer months and when it is easier for the seeds to provide growth, pine cones then open up their scales and allow for seed dispersal to transpire. As a result of this happening, pine cones have proven to be a major contributor to the ongoing evolution of pine trees.

Certain civilizations such as the Pagans worshipped objects that derived from nature such as pine cones as a symbol of everlasting or eternal life. Ever since the process of seed dispersal has been observed as a form of pollination, pine cones have represented the Fountain of Youth or the Fountain of Forever. This depiction of spiritual awakening or immortality has been around for years and it indicates just how much those have believed in their significance.

> Whether for Christmas or other traditions, pine cones present a source of creativity that continues to capture our spirits and enlighten our souls.

Being Stewards of Country

I am a city girl, and while I have always loved visiting the countryside and being surrounded by nature, my home has always been the inner suburbs of Melbourne. I do not have to travel more than fifteen minutes to reach the closest hospital or shops – and that is such a privilege.

Catriona Nguyen-Robertson,
RSV Science Communication Officer

Most Australians are like me – congregated around the coastline. But this land is vast, and while we might not populate it, we all need to be part of the solution when it comes to protecting this it for generations to come.

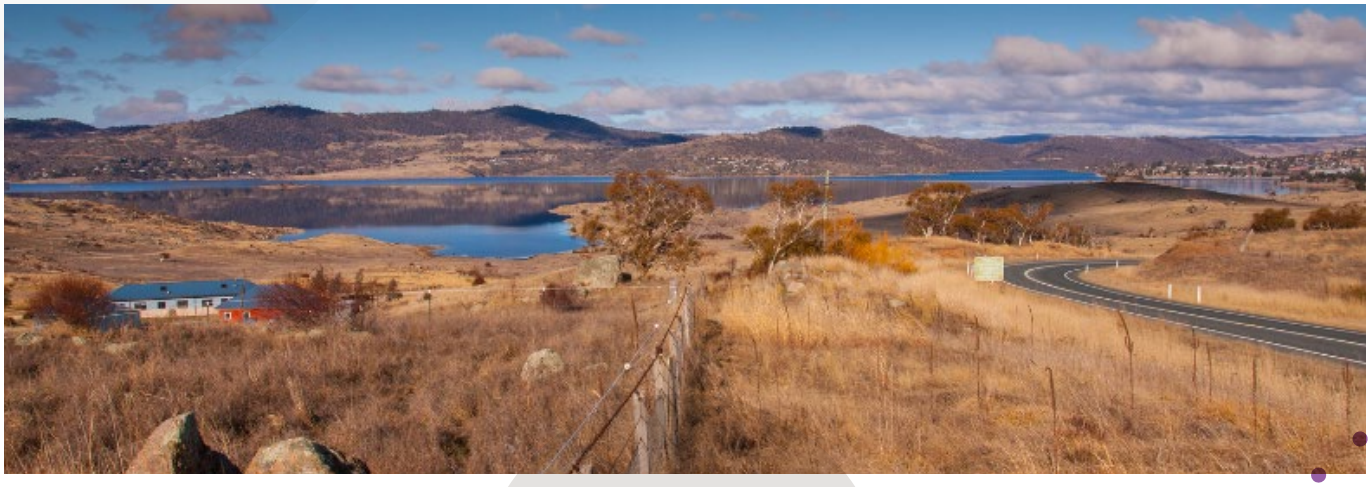
There is no denying that climate change is here. In many of the articles I have written for the Royal Society of Victoria, climate change seems to be a common thread woven among them. In Australia, this means warmer temperatures, less rainfall, and more extreme weather events. How do we ensure our land is ready for the change that is already happening and continues to intensify?

With all the RSV presentations I have heard over the past few years, they only reinforce in my mind our desperate need for better land management. We need to protect our damaged ecosystems so that they are conserved and regenerated for future generations the centuries to come. And it is possible.

For over 65,000 years, these lands have been cared for and protected by Traditional Owners, but in just over 100 years since European invasion, they have seen destruction and a drastic loss in biodiversity.

Although many stories on this topic start off with "doom and gloom" that is, in fact, where many good stories start. If you think about your favourite stories, there is always a problem or some sort of tension that the heroes need to solve. There are many people – heroes – working to change the planet's trajectory. The stories of our lands and seas may get a happy ending yet.

The *Stewardship of Country* series, presented by the Royal Societies of Australia and Inspiring Victoria, showcased discussions of the landscape and environmental stewardship. Later in the year, Inspiring the ACT and Inspiring Victoria also hosted a National Science Week panel on *Indigenous Food and Agriculture*. These discussions bridged Indigenous knowledge with agricultural, scientific, economic, and social perspectives to address the question of who we are becoming as Australians faced with an increasingly unpredictable and challenging future.



It seems like common sense that these groups should all be collaborating. We always look to experts when we want medical advice, a building constructed, etc. Why not listen to experts, First Nations Australians, who truly understand how to care for the land?

The first *Stewardship of Country* webinar explored the convergence of knowledge traditions: Australian Indigenous knowledge, ecological sciences, and European-based farming practices. The *second* focused on untangling those frustrating knots in our system that impede change. The *third* reflected on the natural history of this land to define an approach for the future. It is important that we look to the past and to traditional knowledge to determine how we can move forward and better adapt to address present and future challenges.

There seems to be a great deal of inertia when it comes to creating change. That is why we need catalysts. To use a chemistry analogy, all reactions have an energy barrier: the amount of energy needed for the reaction to occur. Catalysts lower this barrier so that it becomes easier to cross. If we have catalysts who are driving systemic change in the way we look after Country, it might be easier for our society to jump over the hurdle and escape from the familiar, comfortable "business as usual". Otherwise, we will continue to talk about environmental problems without anything being done about them.

Frustratingly, policymakers make grand announcements again and again and create frameworks containing all the words we want to hear – without focusing on how to deliver them. Dr Nicholas Gruen described ways in which, even when people at the top begin with the right intentions, when push comes to shove, they may say one thing while doing another. We need to call out these problems and find ways to leverage the system to fix them and protect Country.

Drawn from the traditions of Aboriginal and Torres Strait Islander cultures, the term "Country" is quite layered. It describes the relationships and interconnectivity between the land, waterways, people, and culture. We use this term to respect the oldest continuous cultures and knowledge systems on the planet. We also use it as a reminder that land, nature, and culture are all connected – if one topples over, they all do.

Uncle Dave Wandin, a Wurundjeri Fire Elder, spoke of Bunjil the Creator's First Law of Country: that we should look after mother. Our mothers take care of us early in life, and we, in turn, look after them later in life as they grow older. This also applies to the spirit of mother. In Melbourne, that is Naarm. The spirit of Naarm is older than the human race, but it is growing tired and weary. We have to take care of her.

Kombumerri person, Adjunct Associate Professor Mary Graham, holds a similar philosophy: the Law of Obligation. Land is the inventor of everything and we are therefore obliged to look after it. 'Stewardship is looking after everyone, but principally, looking after land first,' she says.

We are all individuals, but we are connected because we live on the same land. Mary spoke about having autonomous regard and respect for each other and the land. Cooperate and don't compete, share and don't hoard. It only takes one person to take more than they should for others to then feel like they also need to or else they will be outcompeted, spiralling quickly into a chain reaction. Mary hopes that the Law of Obligation becomes a template for our society.

Cultural severance has drastic consequences. The separation of nature and culture results in dramatic declines in ecosystems, species richness, and landscape quality. European invasion turned the landscape upside down. Conservation should be about caring for the land in ways that we need to learn from its Traditional Owners.

Dr Chris Brady, Peter Christopherson and Justin O'Brien of the Gundjeihmi Aboriginal Corporation propose a stewardship approach: acknowledging connections between social justice and environmental health, and importantly, involving community discussions. They are working to rehabilitate the Ranger Uranium Mine. Justin works with the Mirarr, Traditional Owners of Jaibaru and Kakadu areas, to mitigate the damage from contaminated water and millions of tonnes of waste rock upstream of local communities.

Mirarr never wanted uranium mining on their country. And they have been living with the social, cultural and environmental fallout from the Ranger uranium mine for 40 years. In recognition of the negative impacts of mining, the Northern Territory government established a legacy mine unit in 2013. They promised remediation of the sites as a priority, but communities are still waiting for action.

Hearing about the situation makes me quite ashamed, firstly for being ignorant of it, but mostly for what we have done. Even if I have not contributed personally, it is still my country's leaders, and even possibly money, that support these practices.

'Mining inevitably leads to change,' says Chris. It creates hills, voids, and changes how water flows through an area. This is particularly important to Aboriginal people in the area, as Creation teaches the interconnectedness of landscape. You shouldn't mess with that. Chris and Peter therefore ensure Traditional Knowledge has a practical effect by conveying it in a way that scientists, engineers, and stakeholders can understand. They particularly want to empower Aboriginal people to integrate their knowledge in the rehabilitation of lands once used for mining.

> Greater than 80 percent of the value of minerals extracted from the Northern Territory comes from mining on Aboriginal-owned land, amounting to more than $1 billion a year. They deserve a say in the matter. It is incredibly embarrassing that they have been largely denied one.

Barney Foran advocates for the embracing of Indigenous knowledge given the strong Indigenous ownership of these lands. He advises us to become more systemic about problems in our rangelands, and each region should be empowered to govern their own lands. With a heightened awareness of environmental protection and sustainability, social licence to operate is becoming increasingly important. If companies are using precious natural resources without taking care of the environment or residents, it will fail to build trust and confidence of the community in which it operates. In 2020, Rio Tinto detonated explosives in a part of the Juukan Gorge, destroying two ancient rock shelters in Pilbara dating back 46,000 years, devastating the Puutu Kunti Kurrama and Pinikura people. This travesty is a prime example of how this trust can be completely shattered. We can do better.

Uncle Dave has brought cultural burning back to Coranderrk Station near Healesville after the Wurundjeri people were forced off the land for nearly a century. Following much neglect, the property was covered in weeds, and native seeds struggled to germinate because of introduced pasture grasses. Uncle Dave used a series of carefully controlled burns to promote the growth of native seeds and clear away the pervasive weeds. It took eight weeks to clear the 800m driveway alone, but now the land is bouncing back.

> Trees are growing, helped by the Indigenous students Uncle Dave teaches. Birdsong now fills the air, and wombats, wallabies, echidnas, and other animals have returned. We should be learning from cultural knowledge holders so that Victoria's native plants and wildlife are conserved for future generations – just like they are now thriving on these 200 acres.

Not only do Traditional Land Custodians need to have a seat at the table, but farmers do too. Carolyn Hall leads the Mulloon Institute to form connections between farmers and politicians so that they can share their land management knowledge and ensure that policy meets in the middle. There is an enormous body of knowledge held by land managers that does not seem to break through and resonate with policymakers.

Jody Brown shared her personal experience transitioning to regenerative practices and sustainable land use in agriculture. She works at Latrobe Station, a family-run farm in central west Queensland. After 20 years of farming, the family started to see a decline in parts of their farm's landscape, motivating them to move into rotational grazing practices. Jody was up for the change, but her parents, not so much.

Changing mindsets is important when making transformational change in the landscape, and the motivation can be different for different people. Jody's father wanted an evidence based approach: to hear from people who have been using these alternative practicing in areas with similar climate and landscape before making any changes himself. This led to an online call with ranchers reversing desertification in the Chihuahuan Desert. Mexican ranchers worked with local conservation groups to accrue funding and successfully altered their grazing management in a similarly arid area. Jody emphasised that it is these collaborations and peer networks that will help communities take their first steps towards more regenerative practices as it helps them feel more comfortable with changing their way of life.

But many farmers have given up on the idea of rotational grazing on the Southern Range lands of Western Australia. David Pollock, who works on the range lands, is concerned about the damage caused by unmanaged goats, kangaroos, rabbits, and other animals. Competition and land degradation by these feral animals is a key threat to biodiversity, soils, crop yields, and livestock. Even rotational grazing does not help pastoral lands recover as these animals go where they please, decimating native trees and shrubs as they go. Even small amounts of grazing can have big impacts in areas of low biodiversity and has caused local plant extinctions.

According to David, dingoes are the only cost-effective, long-term solution.

This blows my mind. Relying on dingoes sounds counterintuitive. The misinformation that dingoes are "the enemy" is widespread – and perception is everything. It goes to show that farmers and people who work on the land should be the ones calling the shots, and not people making assumptions about what the land needs. David advocates for the discontinuation dingo elimination as there is a mounting body of evidence that they are needed within the ecosystem. Even if some livestock are harmed by foxes, they would not last long otherwise if we cannot restore the soil and grasses, or if they trip over rabbit holes scattered across the land. We literally cannot afford to deny dingos their role at the top of the ecosystem.

Providing some hope, Nigel Sharp, shared his successes in restoring landscape through investment in biodiversity. He founded Odonata to empower landholders and entrepreneurs to bring the landscape back to life. He encourages landholders to create large, migratory corridors and provide sanctuaries that support threatened species. Already, Eastern Barred Bandicoots, Brush-tailed Rock Wallaby, Eastern Quolls and Tiger Quolls populations have bounced back because of this. If people already have fenced lands, it seems like a no-brainer to house native animals that, in fact, provide benefits such as soil turnover and nourishment. It's a win-win.

> As we push nature to its limits, we have brought about the sixth great mass extinction. Nature is declining faster than ever before. Since European invasion, there have been 110 extinctions recorded (likely an underestimate) and the accelerating extinction rate shows no signs of slowing.

Isolated from the rest of the world, Australia is a biodiversity hotspot. The southwest corner alone developed a whole raft of species and has many endemic plant families. To put this into context, the UK, also an island, has none. In recent decades, there has been an explosion in the number of botanic species identified – even in his own backyard, Professor Kingsley Dixon has discovered new orchids. Seeds spread from the southwest across the land over tens of thousands of years to create a rich tapestry of diverse plant species.

But it did not take long for it to be torn apart. '65 million years in the making, 200 years in the breaking,' says Kingsley. In two centuries, we have cleared, burned, and infected land in the south-west Australian biodiversity hotspot. The landscape has become fragmented, and we are not giving time for species to adapt to our crushing presence.

Since European invasion, there have been 110 extinctions recorded in Australia (likely an underestimate) and the drastically accelerating extinction rate shows no signs of slowing. Since the 1500's, we have lost around 2% of species globally. After hearing a presentation by *Professor Brendan Wintle*, Director of the Threatened Species Recovery Hub, again, I was embarrassed. More plant and mammal species have been declared **ex**tinct in Australia than any other country – that is not something we want to be leading the world in.

As Professor Peter Bridgewater says, 'we, the only species left of our genus, are responsible for this planet.' People arrived on the Australian continent more than 60,000 years ago, crossing through an extraordinary range of climates from tundra to tropical. These people, First Nations people, gained an understanding of the way the lands changed. Different groups had different ways of maintaining Country, but they but they all had one view, basic law and philosophy that united them.

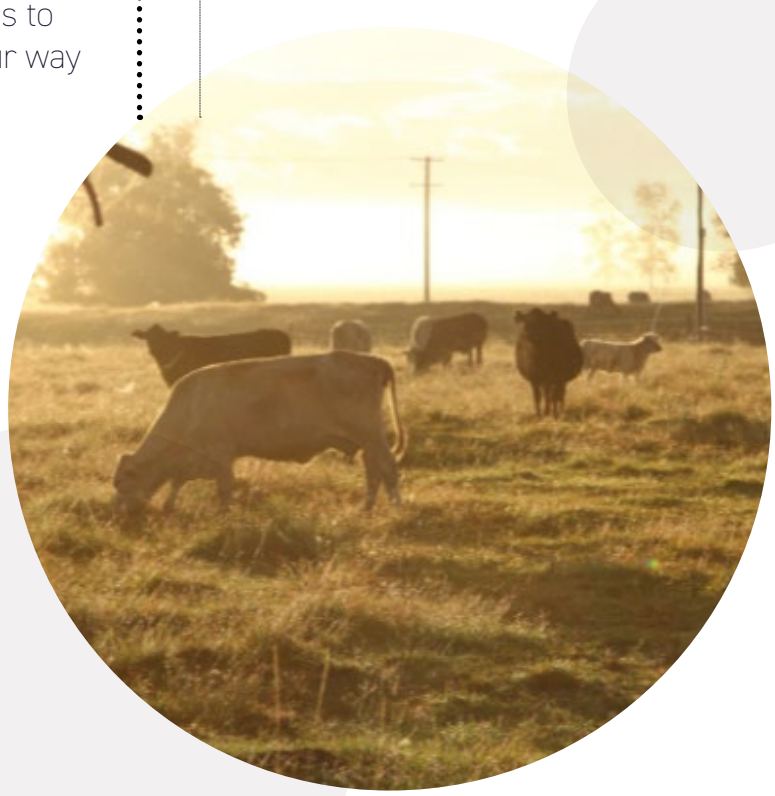
The Law of Obligation is something that we need to follow as a society. Dr Michelle Maloney helps people rethink governance systems and affirms First Nations sovereignty. "Governance" is a term frequently used but I sometimes wonder what it means – and whether the people using it understand what it means too. To Michelle, it means a group of people finding values, rules, and ways of working together. To support more effective stewardship of country, we need deep systems change – it is not merely about people going to the "Outback" and caring for a patch of land. It comes down to the deep-rooted ideas that influence our actions.

Some of our ideas lead to actions that cause great harm to the natural world. We have allowed and supported practices such as land clearing and mining. 'History of European invasion is the history of western ideas coming to these ancient lands,' says Michelle.

> There are 89 bioregions on this continent – the way that Mother Nature defines itself in different regions. They (perhaps not so coincidentally) overlap with many of the borders of distinct Aboriginal and Torres Strait Islander language, social and nation groups and do not abide by the straight lines mapped out as states and territories. Michelle urges us to rethink the straight lines and our way of life.

Professor Will Steffen has highlighted that we have has such a large impact on Earth's systems that we have entered a new geologic epoch. It is one of our own making and has therefore been named the Anthropocene – after humanity, which brought it about. It is therefore on us to change the planet's trajectory away.

So how then do we escape "business as usual" and create meaningful change? Everyone needs to work together: Indigenous knowledge holders, scientists, economists, communities, policymakers. Policy frameworks can create obstacles that distract from the real problems and solutions. There is not enough support from the top to facilitate regenerative practices and a sustainable future. Sometimes I wonder whether we are screaming into the void – or more of an echo chamber. But change can happen. We can be the catalysts. Many people – First Nations people, climate scientists, conservationists, economists, etc. – whom I have heard from over the years have given me hope because of the creative and innovative solutions they put forward. We all can support them, and we all can play a role in conserving and rebuilding Australia's ecosystems and biodiversity. We can be stewards of Country.



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