
THE UNIVERSITY
of ADELAIDE
Annual Report 2020
ENVIRONMENT
INSTITUTE
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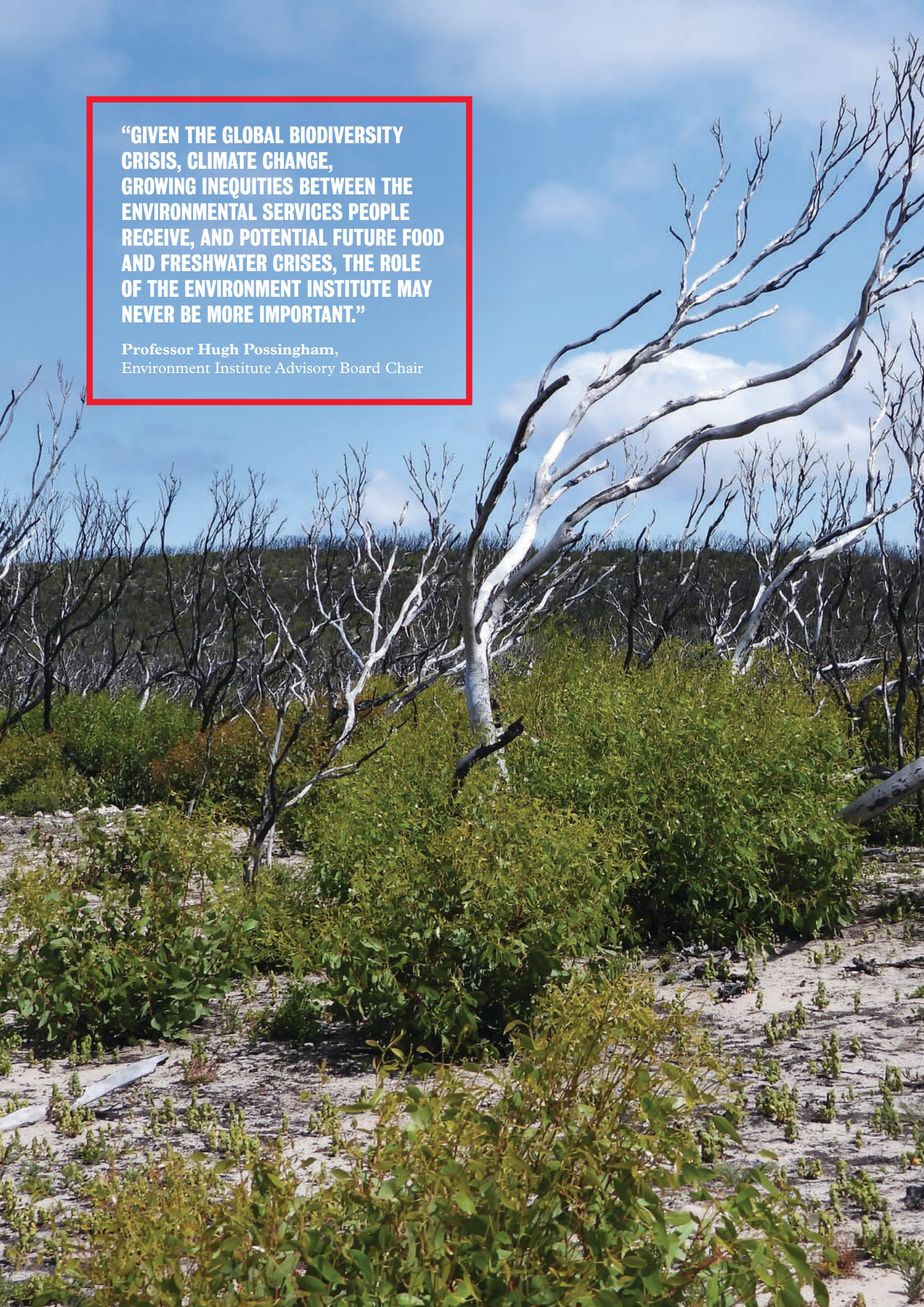

"GIVEN THE GLOBAL BIODIVERSITY CRISIS, CLIMATE CHANGE, GROWING INEQUITIES BETWEEN THE ENVIRONMENTAL SERVICES PEOPLE RECEIVE, AND POTENTIAL FUTURE FOOD AND FRESHWATER CRISES, THE ROLE OF THE ENVIRONMENT INSTITUTE MAY NEVER BE MORE IMPORTANT."

Professor Hugh Possingham,
Environment Institute Advisory Board Chair

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Left: Regeneration of vegetation of the Kangaroo Island bushfires. Photo: Bob Hill

ABOUT THE INSTITUTE

The *Environment Institute* is committed to environmental excellence.

Mission

The *Environment Institute*'s mission is delivering relevant, innovative and actionable outcomes to complex global environmental challenges, to ensure sustainable goals benefit the health of our environment, our wellbeing and support the economy.

Vision

To develop strong local and international collaborations and engagement to address complex future environmental problems while exporting innovation around the world.

There are many complex, global environmental challenges that threaten the health and wellbeing of our delicate ecosystems, communities and economies. *Environment Institute* researchers engage in a diverse range of cross-disciplinary research to gain an understanding of our environmental past and plan for a sustainable future. We play a vital role in translating research into management, policy and technology. With close to 90 research members and significant input from all five Faculties within the University, our membership continues to broaden. The diversity of our membership and our access to outstanding research facilities is a great strength to deliver a holistic approach the global issues.

Here at the *Environment Institute*, we're proud to provide on-going mentoring and leadership development for our early and mid-career researchers. We recognise the importance of providing our less experienced staff every opportunity to succeed in what is an ever more competitive environment. We have witnessed impressive outcomes from this high-quality program including outstanding success in securing competitive funding.

Connecting knowledge to lead change

The Institute has significant experience in delivering outcomes of importance to our environmental wellbeing, industry and government agencies. We provide new knowledge and develop novel tools to better monitor climate change impacts, biodiversity, invasive species and ecosystem health; past, present and future.

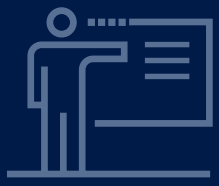
We have experts in:

- Climate change: variation through time, resilience, adaption, mitigation and legal compliance.
- Conservation biology
- Environmental economics
- Evolutionary biology
- Genetics, ancient DNA and DNA barcoding
- Human health, behaviour and mobility
- Landscape transformation and restoration
- Low energy technologies
- Marine and freshwater ecosystems
- Natural hazard risk reduction
- Palaeontology
- Safeguarding biodiversity
- Water quality and supply

The *Environment Institute* is affiliated with the following programs, centre and facilities:

- Adelaide Exposure Science and Health
- Australian Bioactive Compounds Centre
- Australian Centre for Ancient DNA
- Australian Centre for Evolutionary Biology and Biodiversity
- Centre for Applied Conservation Science
- Marine Biology Program
- Spatial Science Research Group
- Sprigg Geobiology Centre
- Unmanned Research Aircraft Facility
- Water Research Centre

AT A GLANCE



36 PROFESSORIAL RESEARCHER LEADERS

89 MEMBERS

AUSTRALIAN RESEARCH COUNCIL FUNDING OUTCOMES

6 Discovery Projects

2 Future Fellowships

4 Linkage Projects

1 Special Research Initiative for Excellence in Antarctic Science

PUBLICATIONS

Our 89 research leaders have produced the following publications in 2020:

636 Journal Articles

5 Books

30 Conference items and papers

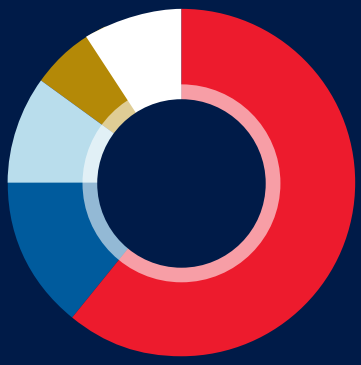
17 Expert reports to external bodies

ARTICLES IN HIGH IMPACT FACTOR JOURNALS

9 15+ JIF* Publications

22 10–14 JIF* Publications

55 6–9 JIF* Publications



MEMBERSHIP BREAKDOWN BY FACULTY**

- 61% Sciences
- 12% Health and Medical Sciences
- 10% Professions
- 7% Arts
- 10% Engineering, Computer and Mathematical Sciences

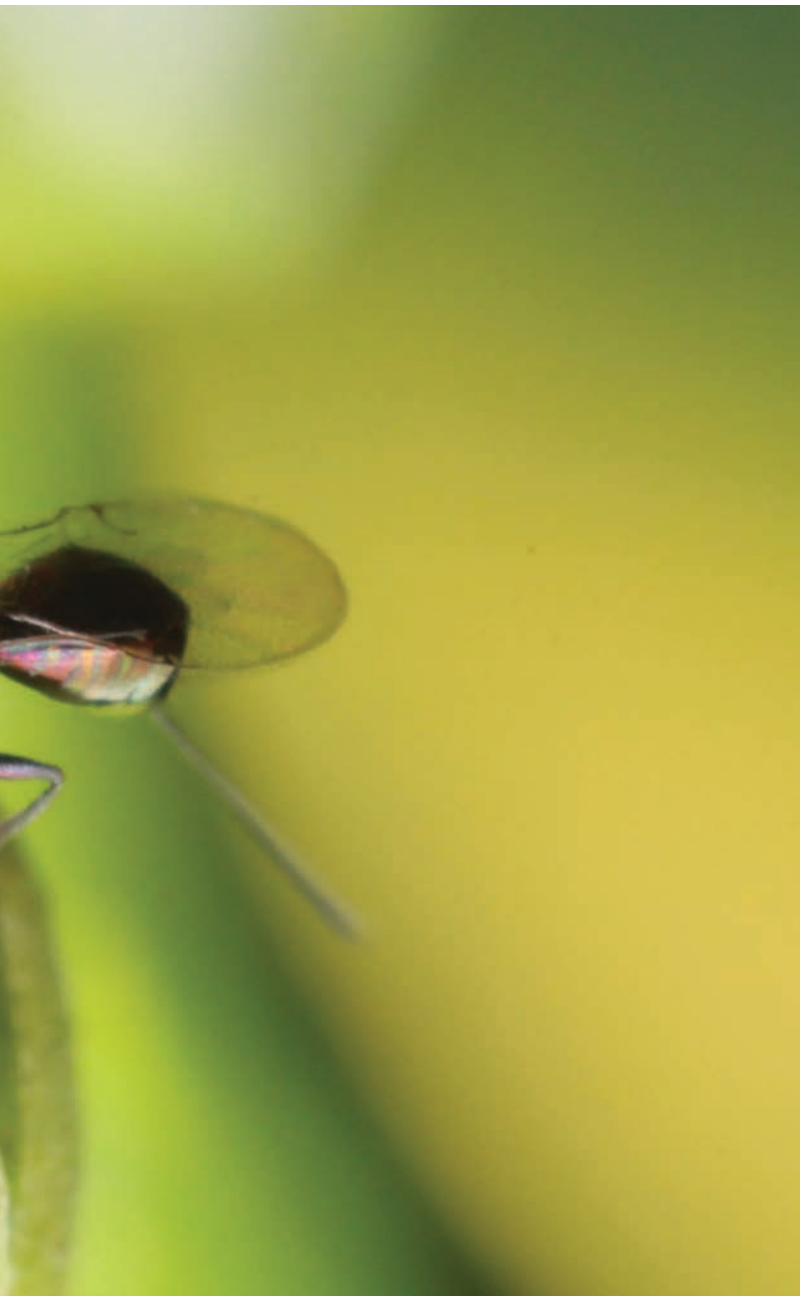
*Journal impact factor
**As at December 2020

HIGHLIGHTS

- **Professor Hugh Possingham**, Queensland Chief Scientist and Chief Scientist at the Nature Conservancy, was appointed Chair of the Environment Institute's Advisory Board.
- *Environment Institute* membership increased from 49 in 2018 to 89 in 2020, strengthening our capacity for multi-disciplinary approaches to environmental challenges.
- Members provided invaluable expertise in the University of Adelaide's response to the 2019-2020 South Australian bushfires including input into capability statements, roundtable meetings, engaging new members and providing support to access relevant funding. **Professor Bob Hill** was invited to join the South Australian Minister for Environment and Water's 'Bushfire Recovery Task Force' which played a strategic role in the recovery effort of our natural environment.
- **Professor Justin Brookes, Professor Michelle Waycott** and **Associate Professor Luke Moseley** and others led successful negotiations for a multi-million dollar grant over 3 years to tackle important environmental issues in the Coorong.
- **Professor Lee Arnold** and **Dr Martina Demuro** co-authored the *Science* paper 'Last Interglacial Iberian Neandertals as Fisher- Hunter-Gatherers' which counters the theory that the success of sapiens relates to a competitive advantage over Neandertals associated with marine resource exploitation and brain development.
- **Professor Christian Doonan** and **Professor Chris Sumby** engaged with Petronas to undertake research on clean methanol synthesis.
- **Associate Professor Phill Cassey** was announced as a Chief Investigator in the 'Securing Antarctica's Environmental Future' research program awarded $36M in federal funding.
- **Professor Frank Grützner** and the Echidna CSI (Conservation Science Initiative) won a grant from the Foundation for National Parks & Wildlife Recovery to study the impact of bushfires on Kangaroo Island echidnas.

Antartica

Parasitoid wasp on floral bud



- Prestigious Australian Research Council Future Fellowship Awards were received by **Dr Martina Demuro** for 'Shedding light on Neanderthal histories using luminescence chronologies', and **Dr Camille Mellin** for 'Safeguarding coral reef fisheries for food security'.
- **Dr Erinn Fagan-Jeffries** received a SA Science Excellence & Innovation Awards for PhD Research Excellence.
- **Professor Ivan Nagelkerken** and **Professor Sean Connell** have found growing evidence that marine ecosystems will not cope well with rising sea temperatures caused by climate change. They have published the findings 'Trophic pyramids reorganize when food web architecture fails to adjust to ocean change' in the journal *Science*.
- Using the past to inform the future, **Associate Professor Damien Fordham** was lead author of the *Science* paper 'Using paleo-archives to safeguard biodiversity under climate change'.
- Congratulations to **Professor Sarah Wheeler**, elected as a Fellow in the Academy of the Social Sciences.
- A team including members of the *Environment Institute*, **Dr Dominic McAfee** and **Dr Heidi Alleway**, was awarded the Australian Museum 2020 NSW Environment, Energy and Science Eureka Prize for Applied Environmental Research, for work on rebuilding Australia's lost shellfish reefs.
- Congratulations to the following members on receiving ARC Discovery Project funding: **Associate Professor Phill Cassey, Dr Thomas Prowse, Professor Frank Grutzner, Dr Juraj Farkas, Professor David Chittleborough, Professor Alan Collins, Dr Francesca McInerney, Professor Jodie Conduit, Dr Georgina Drew and Dr Douglas Bardsley.**

OVERVIEWS

"THE 2020 ANNUAL REPORT HIGHLIGHTS THE STRONG MULTI-DISCIPLINARY RESEARCH DELIVERED BY THE INSTITUTE MEMBERS, AND THEIR POSITIVE IMPACTS."

Professor Anton PJ Middelberg
Deputy Vice-Chancellor (Research)

Deputy Vice-Chancellor (Research)

In a changing environmental landscape marked by disasters and debates, the *Environment Institute*'s systemic approach to complex environmental challenges brings together multidisciplinary teams across science, economics, law, psychology, philosophy, social science and engineering. Its researchers excel on the world stage by tackling important environmental research challenges around water quality, low energy technologies, climate change resilience, adaptation and mitigation, safeguarding biodiversity, conservation biology, marine biology, palaeontology and genetics. Common to all these challenges is a need to translate the science into management, policy and technology.

The 2020 Annual Report highlights the strong multi-disciplinary research delivered by the Institute members, and their positive impacts. The report provides insights into the use of eDNA for effective detection and biomonitoring of subterranean ecosystems; the expertise provided by the *Environment Institute* response to the bushfires in 2019-2020; filling in knowledge gaps of Australia's critical zone; and we listen to the voices of tomorrow and their solutions to climate change through the PlanetFix finalist.

2020 was a strong year for the *Environment Institute* members in the Australian Research Council grant schemes, with members being award six Discovery Projects, four Linkage Projects, two Future Fellowship and a Special Research Initiative for Excellence in Antarctic Science. Highlighting the world-class research and contribution to their fields of research were the five papers published in *Science* and one in *Nature*. Outstanding contributions by Professor Sarah Wheeler to her field was recognised by the election as a Fellow in the Academy of the Social Sciences. It was pleasing to see the next generation of researchers acknowledged with Dr Erinn Fagan-Jeffries receiving at the SA Science Excellence Awards for her PhD Research.

Professor Anton PJ Middelberg
Deputy Vice-Chancellor (Research)

Beach scene in the Coorong National Park, South Australia

Advisory Board Chair

As an alumni and former staff member of The University of Adelaide is a great honour for me to take up the role of the *Environment Institute* Advisory Board Chair.

The environment is a complex place, and solving environmental problems requires knowledge and methods from every discipline. Hence it is pleasing to see the ever-expanding membership of the institute – now 89 researchers.

Given the global biodiversity crisis, climate change, growing inequities between the environmental services people receive, and potential future food and freshwater crises, the role of the *Environment Institute* may never be more important.

Australia has just four "learned academies", admission to which is based on globally significant research and impact based on a lifetime of research. It is especially pleasing to see Professor Sarah Wheeler, who is far from the end of her remarkable career, elected as a Fellow in the Academy of the Social Sciences.

Some other highlights for the year include:

- Increasing grant income at the level of national centres and contracts – for example a contract signed between Professor Christian Doonan and Professor Chris Sumby and Petronas to undertake research on clean methanol synthesis.
- Prestigious Australian Research Council Future Fellowship Awards to Dr Martina Demuro and Dr Camille Mellin.
- Increasing participation on government boards and committees, which is so important to future funding.
- Congratulations to the following Institute members who were awarded ARC Discovery Projects: Associate Professor Phill Cassey, Dr Thomas Prowse Professor Frank Grutzner, Dr Juraj Farkas, Professor Alan Collins, Dr Francesca McInerney, Professor Jodie Conduit, Dr Georgina Drew and Dr Douglas Bardsley.

I have very much enjoyed my first board meetings and I look forward to a new era of impact at state, national and global levels. The global environmental consulting business is burgeoning, and The University of Adelaide has much to offer.

Professor Hugh Possingham
Advisory Board Chair

Director

2020 was an extraordinary year for all of us. At a local level, the devastating bushfires that tore through vast amounts of native vegetation and farmland during the 2019-20 summer provided a shocking reminder of what might be to come with currently uncontrolled climate change impacting ever more deeply. As we were beginning to understand the magnitude of this problem we were struck globally by the Covid-19 pandemic and we all received a strong reminder of how fragile life is and how quickly our comfort zone can be challenged.

Through all of this, the members of the *Environment Institute* displayed exceptional dedication to their chosen field. We sat through seemingly endless on-line meetings and learned whole new ways of operating and trusting each other to perform - everyone responded in a remarkably positive way. When viewed with the benefit of hindsight, the performance of our members stands strongly against all previous years and there is no sign that our members achieved this against such a strange backdrop. Humans are remarkably resilient and tenacious and this can be both a strong positive and also a negative. Our job is to promote the environmental positives and reduce the impacts of the negatives. In 2020 we saw that the environment regained some of its lost image and the researchers who worked hard during the year to allow this to occur deserve special praise.

Professor Bob Hill
Director

eDNA: GROUND-BREAKING IMPLICATIONS FOR THREATENED SPECIES MANAGEMENT IN SUBTERRANEAN GROUNDWATER ENVIRONMENTS

Far from being a sterile habitat, groundwater is home to a wide variety of subterranean life including microbes, worms, arthropods and some vertebrates including cavefish and eels. Many subterranean species have yet to be discovered and described because of the difficulty in exploring these underground environments.

In 2017, WA's mineral and petroleum industry was worth approximately $108.8 billion. These industries are extremely reliant on groundwater for their processes. Protection of this habitat falls within the legislated powers of the WA Environmental Protection Authority (EPA). Compliance with EPA regulation is of the highest priority for resource exploration and developments. There is, therefore, a real need to improve knowledge from biological surveys through emerging technologies.

Environmental DNA (eDNA) metabarcoding has successfully demonstrated that individual species and ecological communities in various environments can be detected without physically catching animals. The *Environment Institute*'s Dr Michelle Guzik and Professor Andy Austin's research, funded by an Australian Research Council Linkage Project announced in early 2020, aims to broaden existing eDNA technologies to transform the assessment of subterranean fauna. "eDNA research on groundwater systems in Australia, and globally, is minimal and has not yet been developed as a tool for standardised and repeatable monitoring of subterranean fauna living in groundwater. This is a technique that obtains DNA sequences from minute quantities shed by animals as they move through the environment," says Dr Guzik. The development of a toolbox of techniques and methods will add value to existing survey methodologies. Ultimately the goal is to produce more efficient, accurate and novel sampling that can better characterise the complete ecological community assemblages of subterranean fauna in the Pilbara region of WA. Targeting these methods for future inclusion into EPA guidelines for improved biomonitoring surveys and better definition of species' distributions for end-users is the ultimate goal.

Above: Researchers from the University of Adelaide in the field in the Pilbara region, Western Australia. Photo: Nick Stevens.
Facing page (from top): Species-specific PCR assays for the blind cave eel (Ophisternon candidum) was designed by sequencing its mitochondrial genome. Photo: Glenn Moore, Western Australian Museum; A subterranean amphipod. Photo: Rachael King, South Australian Museum

In proof-of-concept research, supported by the *Environment Institute*, researchers recently designed new species-specific PCR assays for the highly endemic and vulnerable species, the blind cave eel, *Ophisternon candidum*, by sequencing its mitochondrial genome. They used these new species-specific assays to detect the blind cave eel from eDNA in groundwater samples without physically catching the animals. Water samples were taken from 31 groundwater monitoring bores and two surface locations at the Robe River (Pilbara, WA) and processed back at the lab. We detected the blind cave eel at eight separate locations at our study area; three sites where it has previously been physically detected and, more significantly, at five sites from which the species has never been recorded.

The significance of this study is that it demonstrated that eDNA species-specific PCR assays can be successfully used to detect species from groundwater, without physically catching individuals, at known sites as well as potentially expanding the known distributional range of a species in a very short timeframe. With this information, researchers demonstrated that eDNA can be effectively used for biomonitoring of subterranean fauna. In ongoing research, the program will be expanded for both taxon-specific detection as well as community assemblage characterisation.

This ground-breaking research in the field of groundwater ecology and subterranean biology has been made possible through an ARC Linkage Grant of $490,000 plus $573,000 funding from industry partners and $670,000 in-kind support. Further, as part of the ARC Linkage grant, there is a large collaborative team (Adelaide University, Curtin University, Western Australian Museum, South Australian Museum), stakeholder engagement (WA Department for Water and Environmental Regulation, WA Department for Environment and Attractions, Western Australian Biodiversity Institute), and industry commitment (Rio Tinto, BHP and Chevron), to develop a rigorous and repeatable biomonitoring design for future use in EPA regulated surveys and monitoring.

Dr Guzik's role in building, maintaining and coordinating industry and collaborative partnerships for this project was recognised at the University of Adelaide Executive Dean Faculty of Sciences research awards: 2020 Partnership Development Award.

Further reading

White, N. E., Guzik, M. T., Austin, A. D., Moore, G. I., Humphreys, W. F., Alexander, J., & Bunce, M. (2020). Detection of the rare Australian endemic blind cave eel (*Ophisternon candidum*) with environmental DNA: implications for threatened species management in subterranean environments. *Hydrobiologia*, *847*, 3201-3211.

FOUNDING AN AUSTRALIAN CRITICAL ZONE OBSERVATORY NETWORK

The Australian Critical Zone Observatories network (OZCZO) is the first of its kind in the Southern Hemisphere.

It was funded in 2020 by the Australian Research Council with a $1.2 million Linkage Infrastructure, Equipment and Facilities (LIEF) grant. OZCZO has collaborators across five partner universities – the Universities of Western Australia, New South Wales, Adelaide and Sunshine Coast and the University of Technology Sydney. Professor Wayne Meyer and *Environment Institute*'s Dr Juraj Farkas and Professor David Chittleborough will lead the University of Adelaide's input and the construction and installation of one Critical Zone Observatory in South Australia in the Calperum location.

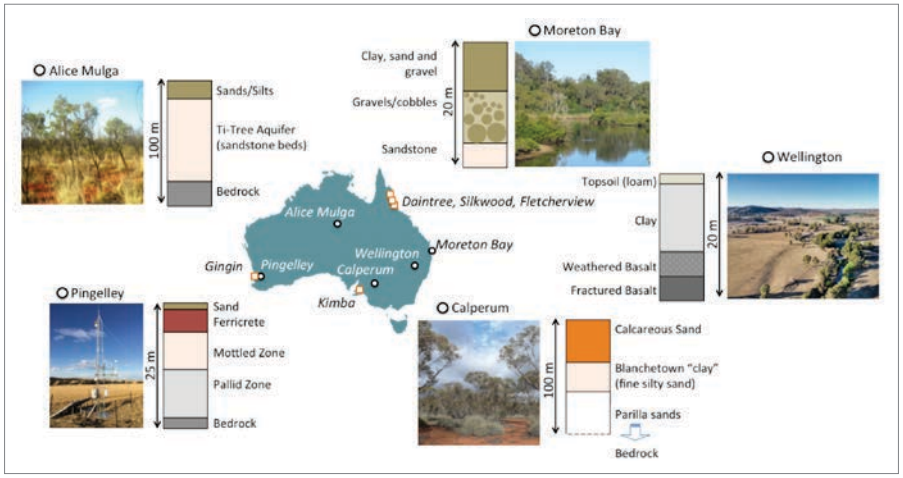


Figure 1: Locations, illustrative photographs and conceptual sketch of representative Critical Zone profiles for the five core OZCZO sites (Alice Mulga, Calperum, Moreton Bay, Pingelly and Wellington), and locations of the five satellite nodes.

The 'critical zone' represents an integrated system for monitoring water, carbon and metal cycling and complex biogeochemical processes in the Earth's surface environment or the outer skin (i.e. regolith) of our planet, thus comprising a 'space between fresh bedrock and fresh air'. OZCZO will thus fill essential knowledge gaps about interactions of under- and above-ground environmental processes and cycling of chemical elements, water and energy in the 'critical zone', including isotope systems of bio-essential elements and heavy metals, and their responses to disturbance and environmental change. These interactions and feedbacks in turn determine the sustainability and availability of food, clean water, mineral resources in regolith, and associated ecosystems, which cannot be studied with existing environmental infrastructure and OZCZO will allow for the first to study these processes on a continent-scale.

The foundational OZCZO network comprises five core and five satellite sites (Figure 1), spread across Australia. At the core sites, LIEF funding will enable augmentation of existing below and above ground infrastructure to bring the sites into parity in their ability and methodologies for monitoring reservoirs and fluxes of energy, carbon, water, and solutes across the critical zone. The main infrastructure components are shown schematically in Table 1 and Figure 2. This will involve the drilling of two vertical borewells, one diagonal borewell with sampling ports (i.e. VMS – Vadose Monitoring System), and employment of a field technician per site and two data technicians for the project for one year. The above-mentioned VMS system, with an online data collection and automated sampling of soil waters, will be unique to Australia as thus far it has been deployed at only one other site, plus our planned OZCZO / VMS monitoring system will be also able to sample and detect changes in soil gases.

The five satellite sites (Figure 1) are intentionally located where a combination of researcher interest, existing infrastructure, and scientific motivations make the extension of the CZO network strategic (i.e. across different climatic zones and bedrock geology). However, no funding is currently being routed to perform systematic research and future monitoring at these sites. Potential satellite sites in Kimba (SA), at Springwood (SE Qld, run by QUT) and Fowlers Gap (western NSW run by UNSW) have considerable ecosystem/geoscience merit and environmental significance and thus these sites may be added to the other 5 satellite sites.

The OZCZO Team are collaborating with various agencies especially three National Collaborative Research Infrastructure Strategy (NCRIS) Programs, TERN, AuScope, and Groundwater, as well as MinEx CRC consortia, that are well-positioned to assist in the development

"OZCZO WILL CATALYSE CRITICAL ZONE SCIENCE IN AUSTRALIA, ENABLING A GREATER UNDERSTANDING OF OUR PRECIOUS RESOURCES AND LIFE HOSTED IN THE OUTER SKIN OF OUR PLANET."

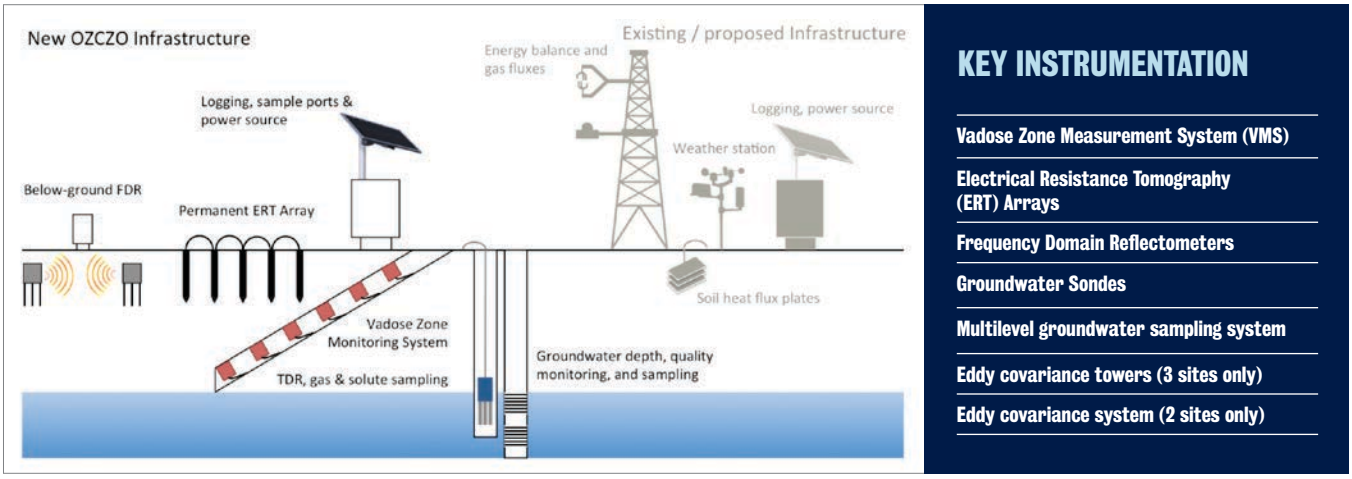


Table 1 / Figure 2: OZCZO below-ground and terrestrial critical zone observational instrumentation. The mix of pre-existing and new instrumentation shown here is applicable to the TERN sites in OZCZO; at Wellington and Moreton Bay the terrestrial eddy covariance instrumentation is also supported by this bid.

of national critical zone science strategy, ideally across a diverse and broad stakeholder network which has 'grown' since LIEF funding was announced. A number of other research grants have now been submitted and/or are in preparation by the OZCZO Team to expand and develop the network and support future research.

In summary, OZCZO will catalyse Critical Zone science in Australia, enabling a greater understanding of our precious resources and life hosted in the outer skin of our planet. The key strength of the LIEF funding is the investment in significant above- and below-ground instrumentation and infrastructure monitoring systems. This is coupled with an excellent, interdisciplinary investigator team that links the project into NCRIS and key focus areas in regolith hosted groundwater and mineral resources, as well as into national modelling programs (principally CABLE) and several other international research networks across various dimensions of Critical Zone science. The *Environment Institute* has supported this project from its conception and provided funding that led to the formulation of the Australian Research Council infrastructure proposal, where the University of Adelaide plays an important role.

THE 2019–2020 SOUTH AUSTRALIAN BUSHFIRE RESPONSE: EMERGING FROM THE ASHES

During the summer of 2019–2020 bushfires ravaged many parts of Australia. They were a devastating reminder of what the future may hold across much of Australia, as we face the challenges of the rapid onset of extreme weather events through climate change.

As temperatures rise and summers become drier, the numbers of days of extreme heat will rapidly increase and the bushfire risk will grow at a faster rate than even the most pessimistic people predicted just a few years ago.

In 2020 there was a spotlight on the damage caused by these bushfires not only to human lives and properties but also to the environment and the iconic native species within it. More than 200,000 hectares of Kangaroo Island was burnt, nearly half the island's total land area, and included some world-famous wilderness areas and the University of Adelaide's Flinders-Baudin Research Centre in Flinders Chase National Park. Research undertaken at the Flinders-Baudin Research Centre contributed to our understanding of flora and fauna, fire and water resource management, other threatening processes and restoration ecology. Countless thousands of vertebrates perished, large tracts of vegetation were cleared, and the total damage to invertebrate species was depressingly vast.

Professor Bob Hill, Director of the *Environment Institute*, was heavily involved in the post-fire recovery work on Kangaroo Island.

Attending a three-day meeting on Kangaroo Island in February, the post-bushfire research response was workshopped. Professor Hill was subsequently appointed as a member of the South Australian Wildlife and Habitat Bushfire Recovery Taskforce, where he led the research response.

Early post-fire impressions were bleak – during a trip to the western end of Kangaroo Island, Professor Hill noted that the landscape was burnt to bare sand, and apart from a lone echidna and a few very sick wallabies near Remarkable Rocks, life appeared to be absent. The lack of background insect noise was eerie. Near Vivonne Bay, where the fire was less intense, there were complete animal skeletons every few metres. On the positive side, even then there were early signs of vegetative regrowth from the mallee eucalypts and the Xanthorrhoeas, but no sign of seed germination.

By mid-2020, the vegetative regrowth from rootstocks was progressing strongly and several species were recovering in that way. Furthermore, the Xanthorrhoeas were flowering, indicating that there would soon be a massive input of seed from that species.

There appeared to be a strong germination response in places from soil-stored seed, but it was too early to be confident about the species present or even the total number of species recovering.

By March 2021 there was abundant regrowth and many species were now present and growing vigorously. The worst fears about the damage to the vegetation have been laid to rest. However, significant questions remain to be answered:

- How quickly will the soil seed bank recover?
- How quickly will species that rely on seed being present on mature plants that are killed by fire (e.g. *Banksia*) recover to the point where they can survive the next fire?
- How will the animal communities that rely on the vegetation for food and shelter recover, especially in the more remote locations?
- What planning needs to be done to best manage the vegetation to survive and thrive following future fires?

The impact of climate change on these and other questions is critical to the future of native habitats on Kangaroo Island. Within the *Environment Institute* there are talented researchers with crucial skills for fire recovery. The University of Adelaide lost an important resource when the Flinders-Baudin Research Centre was destroyed in the fire. It is anticipated that the rebuilding of a new research centre will begin soon and the research we undertake there into the future will contribute to a safer, more fire resilient environment and community. It is imperative that we maintain the push to see genuine change as a result of these fires.

Left: Flinders Chase National Park in February 2020, with vegetation burnt to bare sand. Photo: Bob Hill

Below (left to right): New seedlings of Banksia *below the dead parent plants near Vivonne Bay in February 2021. Photo: Judith Giraldo; A burnt* Banksia *cone near Vivonne Bay in February 2020. The cone has burnt, but it has opened and released seed after the fire. Photo: Bob Hill*

PLANETFIX: COMMUNICATING YOUTH PASSION TOWARDS ENVIRONMENTAL CHALLENGES

In collaboration with the *Advertiser* and *South Australian Science Teachers Association* (SASTA), the *Environment Institute* ran the Planetfix competition for South Australian high school students.

Students were asked, "In 50 words or less, what is your best solution to climate change?".

As leaders of tomorrow, the Institute looked for imaginative solutions from the students. Climate change was shown to be at the forefront of South Australian youth's minds by the creative entries received. The top 12 entries were invited to the University of Adelaide, where participants worked with *Environment Institute* researchers to transform their solution into a larger piece. The top three entries were chosen, and then with the assistance of journalists at *The Advertiser*, they were refined and published in the *Advertiser*.

The *Environment Institute* would like to congratulate Jack Tibby, who wrote PlanetFix's winning entry and Iris Fraser and Sasha Saulwick who were runners-up. Well done to all entrants for their hard work and dedication to a topic that is obviously close to their heart.

We are delighted to highlight the top three entries in the PlanetFix competition, outlining their solution to climate change written in their own words.

Fixing our future matters

By Jack Tibby

From ambitions of full-blown economic revolution to small personal changes, there are a broad range of positions to combat climate change.

But the issue with many is they fail to hold the ruling class of billionaires, CEOs and self-serving politicians to account.

Individuals buying solar panels or electric cars will ultimately prove fruitless if the large-scale polluters are not brought to account.

The practices of billionaires such as Jeff Bezos, Charles Koch and Clive Palmer cause devastation to the world in the form of accelerated climate change.

For example, Bezos's company, Amazon, emitted more than 44 million tonnes of CO_2 in 2018. US company Amazon paid no tax on its profits that year. Even a recent $10 billion commitment by Bezos to help reduce his climate footprint does not go far enough.

The practices of billionaires like Charles Koch and Clive Palmer, who profit from fossil-fuel industries, do huge damage to the environment while campaigning to sway government policy against preventing climate change.

For Koch, this desire has resulted in political actions like promoting the Energy Tax Prevention Act in the US in 2011. This bill stopped the US Environmental Protection Agency from regulating greenhouse gases to address climate change.

Clive Palmer used millions of dollars in personal funds to promote his policies at the last Federal election such as the Adani coal mine.

Many are concerned billionaires don't pay their fair share of taxes, with subsidiary companies in tax-haven nations a common way to reduce the tax burden.

While not all billionaires profit directly from the burning of fossil fuels, many operate energy-consuming businesses powered by fossil fuels.

It is only fair they help to tackle climate change.

I do not want to tar all billionaires with the same brush, but believe billionaires deserve more scrutiny regarding their role in accelerating climate change. I strongly believe the money used to prevent further climate change should be taken from those who have more money than they know what to do with, rather than those who can barely afford to pay rent.

What needs to be implemented is a strong carbon tax on those companies that are causing immense damage to the planet, as well as more monitoring of tax avoidance by individual billionaires. And, to provide incentives for businesses to become less damaging to the environment, more grants should be paid to businesses that record negative emissions.

I believe taxing billionaires and their businesses is the best way to combat climate change. This would be more peaceful than a complete economic revolution and would raise enough money to combat climate change effectively.

Solution simpler than you may think

By Iris Fraser

Searching for a solution to climate change may be more simple than some of us think.

Go outside and take a look around. What do you notice?

Do you see the product of nature producing the air you breathe, taking in the carbon dioxide you breathe out and standing tall and proud right in front of your very eyes?

They are called trees, if you didn't know, and are the solution we have all been looking for. Trees lower temperatures, reduce energy usage, release oxygen into the atmosphere, and reduce and remove pollutants such as carbon dioxide. They offer shade, prevent soil erosion and are homes for birds and wildlife. The world has about 32 per cent tree cover, so more tree planting is needed to sustain life and combat climate change.

By recruiting more passionate volunteers to plant and nurture saplings, and getting help and advice from some of Australia's leading environmental scientists, we can turn every free space into a thriving tree place.

Trees for Life, a non-profit organisation based in Brooklyn Park, is showing the way. Established in 1981, it now has about 7000 active supporters growing and planting native trees suitable for local conditions.

These actions show the path for governments to embrace a policy to plant more trees, not only in the countryside, but in every green space. This includes land strips, traffic islands and on top of high-rise buildings.

A study led by Dr Sebastian Pfautsch in Sydney monitored two suburban streets. One was lined with 10 percent trees and the other 30 percent. The street with less trees experienced 13 days with temperatures above 40 degrees but the area with more tree cover had reduced ground temperatures. Streets with more trees can be up to 10°C cooler.

Dr Pfautsch found at least two trees should be planted in each front yard. Planting this many trees would cut climate change dramatically.

We should all appeal to, and meet with, local, state and federal politicians and use online petitions on websites such as change.org and AVAAZ.org to engage with the community. Let's raise awareness in this fight to tackle climate change.

We can make all free places into thriving tree places by convincing governments to get on board.

One platform to help save the World

By Sasha Saulwick

Our world faces major environmental challenges.

We are seeing increases in severe weather events and natural disasters such as drought, flash floods and fires.

Communities are suffering from record levels of pollution, while mass deforestation and depletion of natural resources is destroying biodiversity.

Yet, in Australia, political power rests with those who neither accept the facts on climate change, nor demonstrate clear leadership on environmental protection.

In the Organisation for Economic Co-operation and Development 2019 Environmental Performance Review Australia ranked as one of the most resource and carbon-intensive OECD countries with a worsening biodiversity rate.

There is little to suggest the Federal Government is addressing this. It is actively encouraging the coal industry, as seen in its final environmental approval of the Adani coal mine in central Queensland last June. It has also set a target for greenhouse gas emission reduction of 26-28 per cent by 2030. This is underwhelming compared with more ambitious targets of other developed nations including the UK (zero net emissions by 2050).

The Government continues to dismiss scientific evidence about human impact on the environment and is ignoring legitimate concerns expressed by scientists and others, including many young people, calling for change.

Now is the time to present solutions to overcome this leadership vacuum. We need to find ways to sidestep our political leaders and become change makers ourselves.

Take, for example, innovations such as Angelina Arora's biodegradable plastic bag made from prawn shells. Using a material which would have been destined for landfill, she has created a product that fully decomposes within 33 days and releases nitrogen into the soil, promoting plant growth. Her invention won the BHP Science and Engineering Award in 2017, leading to a partnership with the CSIRO to refine her design. Manufacturers from several countries have expressed interest.

Who knows about Ananas Anam's pineapple-fibre leather or Lindsay McCormick's zero-plastic toothpaste? These amazing inventions are made using sustainable materials and practices in ways that don't contribute to landfill or carbon emissions.

We need a universally known, overarching platform to showcase these type of emerging technologies, inventions and discoveries.

An online space that promotes innovations which have been tried and tested in the lab. A space that enables innovators and investors to get together with the aim of driving the development and large-scale commercialisation of sustainable projects.

Let's bring all these elements together on a shared network called GloballyGreen. Rather than waiting for politicians to take action, change makers will have a streamlined and efficient way of sharing cutting-edge solutions and putting them into practice.

Ultimately, by opening doors to new green inventions, GloballyGreen will help remediate, repair and restore our natural world.

Our Partners

The Advertiser

SASTA South Australian Science Teachers Association

PUBLIC ENGAGEMENT

Environment Institute **members were active in participating in public engagement opportunities in 2020:**

DATE	SPEAKER	DESCRIPTION
21 February	Prof. Bob Hill	Impact of our changing weather on wildfire behaviour and natural environments (Ecology & Evolution Series)
10 March	Prof. Bob Hill Prof. Holger Maier Assoc. Prof. Melissa Nursey-Bray Assoc. Prof. Doug Bardsley	Firing debate (Research Tuesday series)
12 March	Assoc. Prof. Patrick O'Connor	Late Night Live: The politics of trees (ABC Radio)
23 April	Dr Michelle Lim	In class with … Climate special (Australian Science Channel)
22 July	Prof. Frank Grützner	Using Citizen Science for Research and Engagement: Lessons from EchidnaCSI (Public Engagement in Science and Technology Adelaide)
27 July	Prof. Jodie Conduit	Engaging for social good: Using the principles of customer engagement to improve individual and societal well-being (Professorial Lecture Series)
11 August	Prof. Volker Hessel	Space makers (Research Tuesday series)
20 August	Prof. Frank Grützner Prof. Veronica Soebarto Prof. Sean Connell	What makes science good? How do we know who to trust? How can the public contribute to scientific research? (Public Engagement in Science and Technology Adelaide)
23 August	Assoc. Prof. Diego Garcia-Bellido	The Great South Australian Fossil Debate (SA Museum)
1 September	Prof. Alan Collins	The Flinders Fulcrum – Earth's Proterozoic Pivot (Geological Society of Australia)
4 September	Prof. Sean Connell	Why humanity's future relies on natural diversity (Ecology & Evolution Series)
4 September	Prof. Andy Austin & Dr Steve Donnellan	The biology of parasitic wasps, the most diverse group of animals on the plane. (SA Museum Sprigg Lecture)
25 September	Prof. Bob Hill & Prof. Veronica Soebarto	School of Architecture and Built Environment Research Day
21 October	Tahlia Perry	Echidna CSI (Citizen Science Online Conference)
28 October	Dr Jasmin Packer	Principles for innovation in citizen science (Citizen Science Online Conference)
5 November	Prof. Tim Cavagnaro	Two tales of a city: Carbon neutral Adelaide and urban agriculture in Adelaide (Waite Research Institute Webinar)
10 November	Prof. Andy Lowe	Notifications from nature (Research Tuesday series)

AWARDS AND ACHIEVEMENTS

Congratulations to *Environment Institute* members on their outstanding awards and achievement

AuScope Success

Two pilot projects received funding from the AuScope Opportunity Funds. Dr Juraj Farkas will lead the project 'Securing advanced analytical technology for novel minerals exploration research'. Professor David Chittleborough & Dr Farkas will be involved in the 'Laying the foundations of the Australian Critical Zone Observatories'. This project will produce valuable information on the critical zone in Australia.

Dr Juraj Farkas

ARC Future Fellowship

We are delighted to announce Dr Martina Demuro and Dr Camille Mellin were awarded ARC Future Fellowship Awards. See page 18 for further details.

Dr Camille Mellin

Dr Martina Demuro

Bushfire Recovery Task Force

Professor Bob Hill was invited to join the South Australian Minister for Environment and Water's Bushfire Recovery Task Force which played a strategic role in the bushfire recovery effort.

Eureka Prize

Dr Dominic McAfee, Dr Heidi Alleway and colleagues from the Nature Conservancy, James Cook University and the University of Tasmania, were awarded the NSW Environment, Energy and Science (DPIE) Eureka Prize for Applied Environmental Research for their research towards rebuilding Australia's lost shellfish reefs.

Dr Dominic McAfee

Fellow in the Academy of Social Sciences

We congratulate Professor Sarah Wheeler on being elected as fellow in the Academy of Social Sciences. Her research interests focus on issues with the environment, agriculture, natural resources, climate change, water markets, food and health.

Professor Sarah Wheeler

Hills and Fleurieu Landscape Board

Prof. Andy Lowe has been appointed to the Hills and Fleurieu Landscape Board.

Professor Andy Lowe

Recovery on Kangaroo Island

In collaboration with the Kangaroo Island Landscape Board, *Environment Institute* member, Dr Thomas Prowse was awarded funding through the Wildlife and Habitat Bushfire Recovery Program. He will develop a revegetation strategy to support the conservation of the South Australian Glossy Black-Cockatoo.

Dr Thomas Prowse

South Australian Science Excellence and Innovation Awards

The South Australian Science Excellence and Innovation Awards showcases the best in SA's science community. Congratulations to Dr Erinn Fagan-Jefferies who was the recipient of the 'PhD Research Excellence' award for her PhD which involved discovering new species of parasitoid wasps. Dr Wayne Boardman was a finalist in the 'STEMM Educator of the Year – Tertiary' category. Dr Boardman is a senior lecturer in Wildlife, Biodiversity and Ecosystem Health and Veterinary Biosecurity.

Dr Erinn Fagan-Jefferies

Dr Wayne Boardman

ARC FUNDING OUTCOMES

TYPE	ANNOUNCED	EI INVESTIGATOR(S)	AIM OF PROJECT	AMOUNT
Linkage Project	4	Prof. David Chittleborough & Dr Juraj Farkas*	Founding an Australian Critical Zone Observatory Network. This proposal founds a new network of Australian Critical Zone Observatories. The network will fill essential knowledge gaps about interactions of under- and above-ground environmental processes and their responses to disturbance and change.	$1,205,137
		Dr Robert Fitzpatrick	A National Facility for the 3D Imaging of the Near Surface. This proposal aims to fund the establishment of a National Facility for the 3D Imaging of the Near Surface. It aims to provide Australian researchers with access to next-generation geophysical instruments for high-resolution landscape scale mapping of the shallow subsurface.	$279,591
		Prof. Volker Hessel	Revitalizing facilities for nuclear magnetic resonance in South Australia. Nuclear magnetic resonance (NMR) spectroscopy is the single most powerful spectroscopic tool for determining molecular structure. Our aim is to upgrade NMR infrastructure available to researchers across South Australia with an integrated and complementary array of state-of-the-art spectrometers to diversify usage across a range of disciplines.	$1,240,000
		Prof. Chris Sumby & Prof. Volker Hessel	Structure Determination Pipeline Capabilities for South Australia. This project aims to complete a high-throughput, automated pipeline for biomolecule crystallisation and provide enhanced X-ray structure determination capabilities for all sample types.	$860,365
Future Fellowship	2	Dr Martina Demuro	Shedding light on Neanderthal histories using luminescence chronologies	$866,502
		Dr Camille Mellin	Safeguarding coral reef fisheries for food security.	$739,557

**Lead institution University of Western Australia*

^Lead institution Monash University

Discovery Project	6	Dr Juraj Farkas & Prof. Alan Collins	Glauconite: Archive Recording Timing and Triggers of Cambrian Radiation. This project aims to constrain the timing and speed of the Cambrian radiation of complex animals, and to test potential environmental triggers of this milestone bio-event. New laser mass spectrometry and mineral mapping technology will be integrated to precisely date glauconite – a silicate mineral commonly formed in Cambrian shallow marine animal habitats.	$390,000
		Prof. Frank Grutzner	Evolution and function of mammalian sex chromosomes. Research on iconic Australian mammals has profoundly reshaped our understanding of reproductive biology and sex chromosome evolution. In this project we combine unique expertise, international collaboration and novel genetic information about Australia's unique egg-laying mammals (echidna and platypus) to investigate major aspects of reproduction.	$812,340.00
		Assoc. Prof. Phill Cassey & Dr Thomas Prowse	Drivers of the live pet trade in Australian reptiles. This project aims to understand the complex trade in live Australian reptiles. The global pet trade is a major threat to biodiversity.	$420,851
		Dr Georgina Drew & Assoc. Prof. Douglas Bardsley	Hydrosocial Adaptations to Water Risk in Australian Agriculture. This project aims to understand how Australian farmers adapt to water resource limitations and governance constraints. We will address this significant challenge by identifying how social and cultural perceptions of water risk inspire farmers to create resilient management solutions in line with policy guidelines.	$217,656
		Dr Francesca McInerney	Fire and rain: Drivers of deep-time ecosystem assembly in Australia. This project aims to investigate the influence of bushfires and shifting rainfall patterns on the development of Australia's dominant ecosystems.	$476,000
Special Research Initiative for Excellence in Antarctic Science	1	Assoc. Prof. Phillip Cassey^	**Securing Antarctica's Environmental Future.** This program aims to deliver unprecedented research capability for securing Antarctic environments in the face of uncertain change. By integrating a highly skilled team with new approaches and breakthrough technologies, the program anticipates discovery science, enhanced environmental forecasting and optimised decision-making to advance Australia's position as an influential Antarctic nation.	$36,000,000

ENVIRONMENT INSTITUTE ADVISORY BOARD MEMBERS

Professor Hugh Possingham

Queensland Chief Scientist

Professor Hugh Possingham has had a long and distinguished career developing mathematical and economic tools for solving nature conservation problems such as where to place protected areas and which are the most efficient actions for saving threatened species. Most notably his co-development of the Marxan software for conservation planning, has been described as "the most significant contribution to conservation biology to emerge from Australia's research community."

He has co-authored more than 650 peer-reviewed papers, with more than 30 in the world's top two scientific journals *Science* and *Nature*.

He has held positions at the University of Adelaide and the University of Queensland, where he has led several research centres and held Australian Research Council Professorial, Laureate and Federation Fellowships.

Hugh was the Director of the Australian Research Council Centre of Excellence for Environmental Decisions and Australian government's Threatened Species Recovery Hub, Chief Scientist at The Nature Conservancy (2016) and Queensland's Chief Scientist (2020). Hugh was elected a Fellow of the Australian Academy of Science (2005) and a Foreign Associate of the US National Academy of Sciences (2016).

Professor Richard Hillis

Pro Vice-Chancellor (Research Performance), University of Adelaide

Richard is the Pro Vice-Chancellor (Research Performance), providing leadership in achieving the University's strategic goals in relation to research quality, revenue, productivity and international standing. Richard spent 18 years at the University of Adelaide (1992-2010) where he was Mawson Professor of Geology, State of South Australia Chair of Petroleum Geology and Head of the Australian School of Petroleum. From 2010-2018 Richard was CEO of the Deep Exploration Technologies Cooperative Research Centre (DET CRC) which developed transformational technologies for mineral exploration. Richard is a Fellow of ATSE (Australian Academy of Technology and Engineering) and of the Geological Society of Australia. He was awarded the Geological Society of Australia's Webb Medal for leadership in the earth sciences (2014) and South Australian Scientist of the Year (2018).

Ms Sandy Carruthers

Director of Science, Department for Environment and Water

Sandy is the Director of Science for the Department for Environment and Water (DEW). Through her role, Sandy is accountable for the coordination and delivery of DEW's core science capability to support NRM in South Australia. She plays a key role in the interface between NRM science, policy and delivery in South Australia, and recently led the development of a Research Partnership Strategy for DEW, to support the critical relationships between DEW and the South Australian research sector.

Dr Susannah Eliott

Chief Executive Officer, Australian Science Media Centre

Susannah has more than 20 years of practical experience in science communication. Susannah is currently CEO of the Australian Science Media Centre, an independent not for profit organisation that works with the news media to highlight the scientific evidence behind the story. Previously appointed to the national Climate Commission and Chair for the Expert Working Group on Science and the Media for the Federal Government. She currently sits on the Federal Government's Science Sector Working Group.

Ms Elaine Bensted

Chief Executive, Zoos South Australia

Elaine is the Chief Executive of Zoos South Australia. Since being in the role she has led an improvement in the financial position of this conservation charity and an increase in Zoos SA membership base from 26,000 to over 40,000. Elaine has previously held senior positions in State and Local Government, and the private sector in the finance industry.

Professor Chris Daniels

Director of Cleland Wildlife Park, Department for Environment and Water

Chris is the Director of Cleland Wildlife Park (Department for Environment and Water, SA Government). He is also involved in many other environmental leadership activities focused on conserving wildlife and connecting people with nature. Chris has published 9 books, 1 DVD and over 250 scientific and community publications. He received a Doctor of Science (DSc) from the University of Adelaide in 2018.

OUR LEADING MEMBERS

MANAGEMENT COMMITTEE

Professor Bob Hill
Director, Environment Institute

Professor Bronwyn Gillanders
Deputy Director, Environment Institute
Director of Marine Biology Program

Professor Seth Westra
Civil, Environmental & Mining Engineering

Professor Sarah Wheeler
Global Food and Resources

Ms Leah Panakera-Thorpe
Institute Manager

INSTITUTE STAFF

Ms Annemarie Gaskin
Digital Marketing Coordinator

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Professor Jodie Conduit

Adelaide Law School
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Professor Paul Babie
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Dr Michelle Lim
Dr Nengye Liu

Agriculture, Food and Wine
Professor Tim Cavagnaro
Dr Katja Hogendoorn
Associate Professor Luke Mosley

Animal and Veterinary Sciences
Dr Wayne Boardman
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Professor Veronica Soebarto
Dr Tanya Court
Dr Scott Hawken

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Associate Professor Jeremy Austin
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Professor Andrew Austin
Director, Australian Centre for Evolutionary Biology and Biodiversity

Professor Justin Brookes
Director, Water Research Centre

Professor Sean Connell
Marine Biology Research Leader

Professor Robert Fitzpatrick
Director, Acid Sulfate Soil Centre

Professor Frank Grutzner
Molecular and Biomedical Science

Professor Kristofer Helgen
Deputy Director, Centre for Applied Conservation Science

Professor Megan Lewis
Spatial Science Research Leader

Professor Andy Lowe
Director of the Centre for Conservation Science and Technology

Professor Ivan Nagelkerken

Professor Michelle Waycott
Chief Botanist, State Herbarium of SA

Professor Philip Weinstein
Director, Australian Bioactive Compounds Centre

Professor Tom Wigley (Adjunct)

Associate Professor Phill Cassey
Director, Centre for Applied Conservation Science

Associate Professor Bertram Ostendorf
Dr Simon Baxter
Dr Damien Fordham
Dr Diego Garcia-Bellido
Dr Alice Jones
Dr Bastien Llamas
Dr Jasmin Packer
Dr Nastaran Mazloumi (Adjunct)
Dr Dominic McAfee
Dr Ramesh Raja Segaran
Dr Kate Sanders
Dr Emma Sherratt
Dr Yassine Souilmi
Dr Myall Tarran (Adjunct)
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Professor Mike Young
Associate Professor Patrick O'Connor

Humanities
Professor Garret Cullity

Mathematical Sciences
Dr Thomas Prowse

Physical Sciences
Professor Alan Collins
Professor David Chittleborough (Adjunct)
Professor Christian Doonan
Professor Nigel Spooner
Professor Christopher Sumby
Associate Professor Lee Arnold
Dr Juraj Farkas
Dr Cesca McInerney
Dr Liz Reed
Dr Jonathan Tyler

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Professor Anna Chur-Hansen
Professor Sandra Hodge
Professor Deb Turnbull
Associate Professor Rachel Roberts
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Dr Carolyn Semmler

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Professor Dino Pisaniello
Director, Director of Adelaide Exposure Science and Health

Dr Sharyn Gaskin
Deputy Director, Director of Adelaide Exposure Science and Health

Professor Peng Bi
Dr Leigh Threadgold
Dr Len Turczynowicz

Social Sciences
Associate Professor John Tibby
Director, Sprigg Geobiology Centre

Associate Professor Doug Bardley
Associate Professor Melissa Nursey-Bray
Associate Professor Yan Tan
Dr Benito Cao
Dr Georgina Drew

PARTNER MEMBERS

Professor Steven Cooper (Adjunct)
Principal Researcher, SA Museum

Professor Stephen Donnellan
Genetics and Evolution, SA Museum

2020 CITATION STATISTICS

Listed alphabetically below are citation statistics of *Environment Institute* researchers. These statistics offer insights into the impact of individual authors in their chosen field.

RESEARCHER	NUMBER OF CITATIONS IN 2020 Number of times an article has been cited by another article	H-INDEX Number of publications with a citation number greater than or equal to h	i10-INDEX Number of publications with at least 10 citations.
Dr Lee ARNOLD	616	30	48
Prof. Andrew AUSTIN	600	51	163
Assoc Prof. Jeremy AUSTIN	572	42	86
Dr Doug BARDSLEY	202	22	33
Dr Simon BAXTER	616	35	46
Prof. Peng BI	1002	46	113
Dr Wayne BROADMAN	152	16	31
Prof. Justin BROOKES	894	46	89
Assoc Prof. Peter BURDON	109	10	11
Assoc Prof. Phill CASSEY	1364	47	172
Prof. Anna CHUR-HANSEN	437	30	69
Prof. Alan COLLINS	1518	53	133
Prof. Sean CONNELL	1487	65	156
Prof. Alan COOPER	2912	83	199
Prof. Steven COOPER	452	43	110
Prof. Stephen DONNELLAN	619	45	129
Prof. Christian DOONAN	1735	44	88
Dr Georgina DREW	49	9	8
Dr Juraj FARKAS	165	14	19
Prof. Robert FITZPATRICK	395	39	154
Dr Damien FORDHAM	517	30	68
Dr Diego GARCIA-BELLIDO	297	24	44
Dr Sharyn GASKIN	58	9	9
Prof. Bronwyn GILLANDERS	1201	57	148
Prof. Michael GOODSITE	326	28	48
Prof. Frank GRUTZNER	534	35	60
Prof. Kristofer HELGEN	1221	41	120
Prof. Volker HESSEL	2105	72	306

RESEARCHER	NUMBER OF CITATIONS	H-INDEX	i10-INDEX
Prof. Bob HILL	461	57	176
Dr Mark KOHLER	211	22	32
Dr Bastien LLAMAS	985	27	45
Prof. Megan LEWIS	259	24	42
Dr Michelle LIM	35	7	3
Dr Nengye LIU	26	6	4
Prof. Andy LOWE	1469	60	163
Prof. Holger MAIER	1907	60	201
Dr Francesca MCINERNEY	528	18	26
Prof. Ivan NAGELKERKEN	1416	61	141
Assoc Prof. Melissa NURSEY-BRAY	237	19	31
Assoc Prof. Patrick O'CONNOR	164	12	16
Assoc Prof. Bertram OSTENDORF	294	27	56
Dr Jasmin PACKER	42	8	7
Prof. Dino PISANIELLO	420	32	62
Dr Thomas PROWSE	225	17	29
Dr Liz REED	28	10	12
Dr Frank REITH	500	25	55
Dr Kate SANDERS	402	22	32
Assoc Prof. Carolyn SEMMLER	122	14	16
Dr Emma SHERATT	383	19	25
Prof. Veronica SOEBARTO	382	25	49
Prof. Nigel SPOONER	373	35	74
Prof. Christopher SUMBY	558	34	75
Assoc Prof. Yan TAN	240	20	35
Dr Vicki THOMSON	63	8	7
Dr Leigh THREDGOLD	8	4	1
Dr John TIBBY	235	30	60
Dr Jonathan TYLER	162	15	19
Prof. Michelle WAYCOTT	1193	44	93
Prof. Philip WEINSTEIN	841	47	175
Prof. Seth WESTRA	1056	33	58
Dr Laura WEYRICH	498	20	30
Prof. Sarah WHEELER	437	29	55
Dr Fiona WHELAN	38	10	10
Prof. Tom WIGLEY	1807	111	287
Prof. Mike YOUNG	93	23	47

SELECTED PUBLICATIONS

The following list has been complied from Altmetrics and comprises our top 20 publications that have attracted online attention and around the world. *Environment Institute* researchers are shown in bold type and articles are listed based on their Altmetric attention score.

Hocknull, S. A., Lewis, R., **Arnold, L. J.**, Pietsch, T., Joannes-Boyau, R., Price, G. J., Moss, P., Wood, R., Dosseto, A., Louys, J., Olley, J., & Lawrence, R. A. (2020). Extinction of eastern Sahul megafauna coincides with sustained environmental deterioration. *Nature Communications, 11*(1). https://doi.org/10.1038/s41467-020-15785-w

Zilhão, J., Angelucci, D. E., Igreja, M. A., **Arnold, L. J.**, Badal, E., Callapez, P., Cardoso, J. L., d'Errico, F., Daura, J., **Demuro, M.**, Deschamps, M., Dupont, C., Gabriel, S., Hoffmann, D. L., Legoinha, P., Matias, H., Monge Soares, A. M., Nabais, M., Portela, P., & Queffelec, A. (2020). Last Interglacial Iberian Neandertals as fisher-hunter-gatherers. *Science*, *367*(6485). https://doi.org/10.1126/science.aaz7943

You, M., Ke, F., You, S., Wu, Z., Liu, Q., He, W., **Baxter, S. W.**, Yuchi, Z., Vasseur, L., Gurr, G. M., Ward, C. M., Cerda, H., Yang, G., Peng, L., Jin, Y., Xie, M., Cai, L., Douglas, C. J., Isman, M. B., & Goettel, M. S. (2020). Variation among 532 genomes unveils the origin and evolutionary history of a global insect herbivore. *Nature Communications, 11*(1). https://doi.org/10.1038/s41467-020-16178-9

Marcy, A. E., Guillerme, T., **Sherratt, E.**, Rowe, K. C., Phillips, M. J., & Weisbecker, V. (2020). Australian Rodents Reveal Conserved Cranial Evolutionary Allometry across 10 Million Years of Murid Evolution. *The American Naturalist*, *196*(6), 755–768. https://doi.org/10.1086/711398

Turney, C. S. M., Fogwill, C. J., Golledge, N. R., McKay, N. P., van Sebille, E., Jones, R. T., Etheridge, D., Rubino, M., Thornton, D. P., Davies, S. M., Ramsey, C. B., Thomas, Z. A., Bird, M. I., Munksgaard, N. C., Kohno, M., Woodward, J., Winter, K., **Weyrich, L. S.**, Rootes, C. M., & Millman, H. (2020). Early Last Interglacial ocean warming drove substantial ice mass loss from Antarctica. *Proceedings of the National Academy of Sciences, 117*(8), 3996–4006. https://doi.org/10.1073/pnas.1902469117

Paterson, J. R., Edgecombe, G. D., & **García-Bellido, D. C.** (2020). Disparate compound eyes of Cambrian radiodonts reveal their developmental growth mode and diverse visual ecology. *Science Advances*, 6(49), eabc6721. https://doi.org/10.1126/sciadv.abc6721

Fordham, D. A., Jackson, S. T., Brown, S. C., Huntley, B., Brook, B. W., Dahl-Jensen, D., Gilbert, M. T. P., Otto-Bliesner, B. L., Svensson, A., Theodoridis, S., Wilmshurst, J. M., Buettel, J. C., Canteri, E., McDowell, M., Orlando, L., Pilowsky, J., Rahbek, C., & Nogues-Bravo, D. (2020). Using paleo-archives to safeguard biodiversity under climate change. *Science*, *369*(6507), eabc5654. https://doi.org/10.1126/science.abc5654

Nakatsuka, N., Lazaridis, I., Barbieri, C., Skoglund, P., Rohland, N., Mallick, S., Posth, C., Harkins-Kinkaid, K., Ferry, M., Harney, É., Michel, M., Stewardson, K., Novak-Forst, J., Capriles, J., Durruty, M., Álvarez, K., Beresford-Jones, D., Burger, R., Cadwallader, L., Fujita, R., Isla, J., Lau, G., Aguirre, C., LeBlanc, S., Maldonado, S., Meddens, F., Messineo, P., Culleton, B., Harper, T., Quilter, J., Politis, G., Rademaker, K., Reindel, M., Rivera, M., Salazar, L., Sandoval, J., Santoro, C., Scheifler, N., Standen, V., Barreto, M., Espinoza, I., Tomasto-Cagigao, E., Valverde, G., Kennett, D., Cooper, A., Krause, J., **Haak, W.**, **Llamas, B.**, Reich, D. & Fehren-Schmitz, L., 2020. A Paleogenomic Reconstruction of the Deep Population History of the Andes. *Cell, 181*(5), pp.1131-1145.e21. https://doi.org/10.1016/j.cell.2020.04.015

Jones, A. R., Jessop, T. S., Ariefiandy, A., Brook, B. W., Brown, S. C., Ciofi, C., Benu, Y. J., Purwandana, D., Sitorus, T., **Wigley, T. M. L.**, & **Fordham, D. A.** (2020). Identifying island safe havens to prevent the extinction of the World's largest lizard from global warming. *Ecology and Evolution, 10*(19), 10492–10507. https://doi.org/10.1002/ece3.6705

Bajo, P., Drysdale, R. N., Woodhead, J. D., Hellstrom, J. C., Hodell, D., Ferretti, P., Voelker, A. H. L., Zanchetta, G., Rodrigues, T., Wolff, E., **Tyler, J.**, Frisia, S., Spötl, C., & Fallick, A. E. (2020). Persistent influence of obliquity on ice age terminations since the Middle Pleistocene transition. *Science, 367*(6483), 1235–1239. https://doi.org/10.1126/science.aaw1114

Fogwill, C., Turney, C., Menviel, L., Baker, A., Weber, M., Ellis, B., Thomas, Z., Golledge, N., Etheridge, D., Rubino, M., Thornton, D., van Ommen, T., Moy, A., Curran, M., Davies, S., Bird, M., Munksgaard, N., Rootes, C., Millman, H., Vohra, J., Rivera, A., Mackintosh, A., Pike, J., Hall, I., Bagshaw, E., Rainsley, E., Bronk-Ramsey, C., Montenari, M., Cage, A., Harris, M., Jones, R., Power, A., Love, J., Young, J., **Weyrich, L.** & Cooper, A., (2020). Southern Ocean carbon sink enhanced by sea-ice feedbacks at the Antarctic Cold Reversal. *Nature Geoscience, 13*(7), pp.489-497. https://doi.org/10.1038/s41561-020-0587-0

Wyborn, C., Davila, F., Pereira, L., **Lim, M.**, Alvarez, I., Henderson, G., Luers, A., Martinez Harms, M. J., Maze, K., Montana, J., Ryan, M., Sandbrook, C., Shaw, R., & Woods, E. (2020). Imagining transformative biodiversity futures. *Nature Sustainability, 3*(9), 670–672. https://doi.org/10.1038/s41893-020-0587-5

Brown, S. C., **Wigley, T. M. L.**, Otto-Bliesner, B. L., Rahbek, C., & **Fordham, D. A.** (2020). Persistent Quaternary climate refugia are hospices for biodiversity in the Anthropocene. *Nature Climate Change, 10*(3), 244–248. https://doi.org/10.1038/s41558-019-0682-7

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