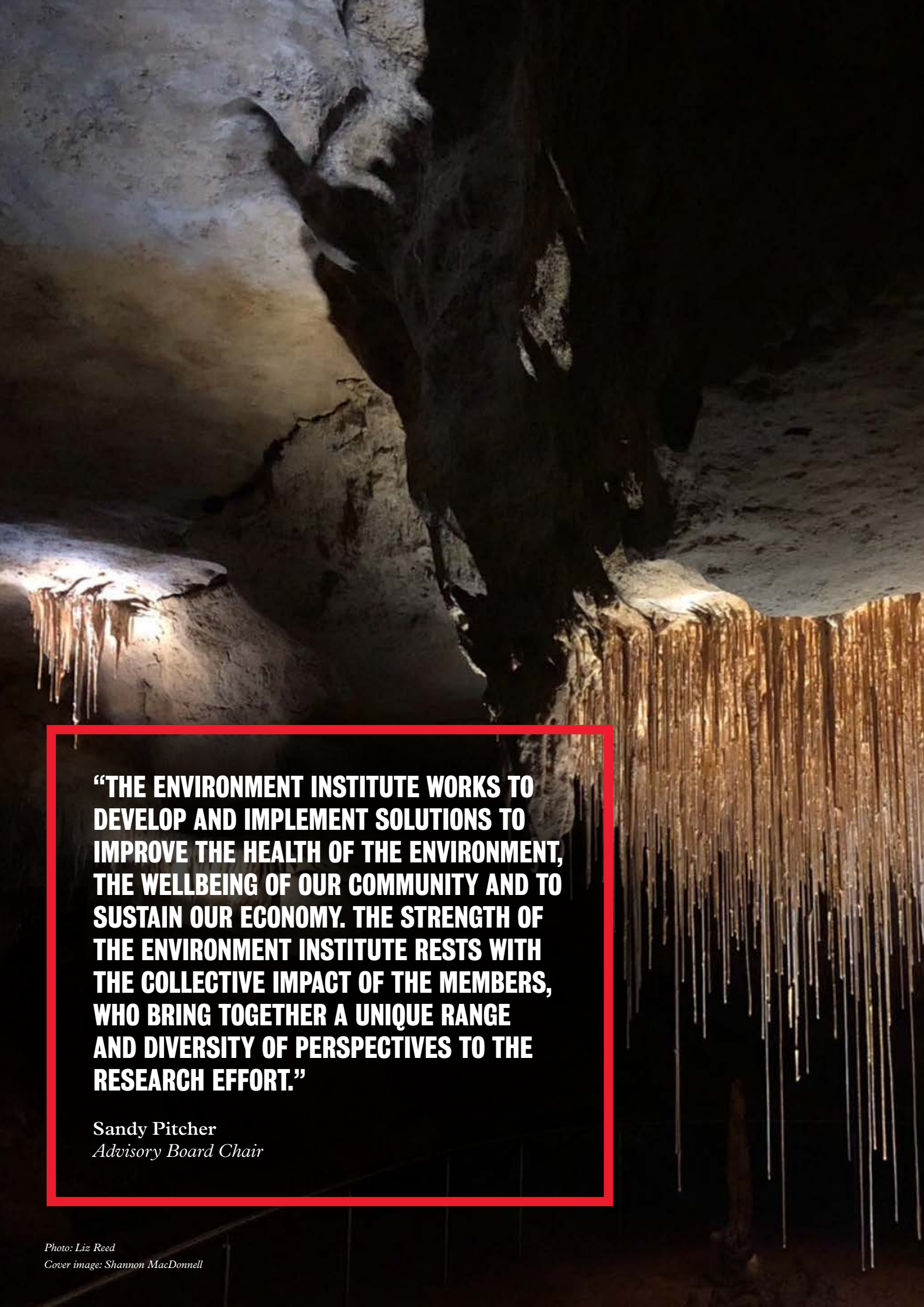
THE UNIVERSITY of ADELAIDE

Annual Report 2018

ENVIRONMENT INSTITUTE

adelaide.edu.au/environment



“THE ENVIRONMENT INSTITUTE WORKS TO DEVELOP AND IMPLEMENT SOLUTIONS TO IMPROVE THE HEALTH OF THE ENVIRONMENT, THE WELLBEING OF OUR COMMUNITY AND TO SUSTAIN OUR ECONOMY. THE STRENGTH OF THE ENVIRONMENT INSTITUTE RESTS WITH THE COLLECTIVE IMPACT OF THE MEMBERS, WHO BRING TOGETHER A UNIQUE RANGE AND DIVERSITY OF PERSPECTIVES TO THE RESEARCH EFFORT.”

Sandy Pitcher
Advisory Board Chair

Photo: Liz Reed
Cover image: Shannon MacDonnell

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VISION

The Environment Institute is committed to environmental excellence. To enable this, it brings together leading water and climate scientists and researchers in fields including conservation biology, climate adaptation and mitigation, biodiversity, marine biology, landscapes, palaeontology and genetics.

By developing strong international collaboration and external engagement we can address complex environmental problems and export innovation to the world.

Connecting knowledge to lead change

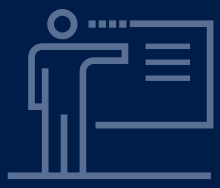
Our environmental specialists work together on projects to deliver relevant, innovative and actionable outcomes in areas of importance to the Australian community including:

- Water
- Biodiversity
- Conservation biology
- Landscape transformation and restoration
- Oceans and marine biology
- Climate change, resilience, adaptation and mitigation
- Genetics, ancient DNA and DNA barcoding
- Palaeontology
- Evolutionary biology

The Environment Institute is affiliated with the following programs:

- 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
- Water Research Centre

2018 AT A GLANCE



20 PROFESSORIAL RESEARCHER LEADERS

49 MEMBERS

AUSTRALIAN RESEARCH COUNCIL FUNDING OUTCOMES

6 Discovery Project

1 Discovery Early Career Research Award

1 ARC Future Fellowship

PUBLICATIONS

Our 49 research leaders have produced the following publications in 2018:

311 Journal Articles

1 Book

29 Conference Papers

11 Expert reports to external bodies

ARTICLES IN HIGH IMPACT FACTOR JOURNALS

9 15+ JIF* Publications

17 10–14 JIF* Publications

18 6–9 JIF* Publications

*Journal impact factor

HIGHLIGHTS

- The Aboriginal Heritage Project, partnership between the local members of the Aboriginal community, the SA Museum, Australian Centre for Ancient DNA, the University of New South Wales won the South Australian Science Awards Excellence in Research Collaboration award.
- Dr Liz Reed was recognised as the 2018 Unsung Hero of South Australia Science Communication.
- Research into irrigation efficiency to mitigate global water scarcity by Professor Sarah Wheeler and her colleagues resulted in a paper titled 'The paradox of irrigation efficiency' published in *Science*.
- Professor Kris Helgen has been involved in a large collaborative study, across 24 institutes, which researched the adaption and conservation insights from the koala genome in *Nature Genetics*. The research has gained a lot of attention across various news outlets.
- An international group of researchers, including Prof. Alan Cooper (ACAD) uncovered remarkable details about the population history of Central and South America. Published in *Cell*, the article 'Reconstructing the deep population history of Central and South America' revealed two previously unknown genetic exchanges between North and South America.
- The Environment Institute welcomed three new Advisory Board members: Professor Bruce Northcote, Director, Office DV&VP(R), Ms Elaine Bensted, Chief Executive of ZooSA and Professor Chris Daniels, Director Cleland Wildlife Park.
- The Australian Research Council (ARC) has awarded Dr Laura Weyrich a Future Fellowship and Dr Raymond Tobler a Discovery Early Career Researcher Award (DECRA).

OVERVIEWS

Photo: Liz Reed

Deputy Vice-Chancellor (Research)

The University's mission to conduct world-class research and innovation, engage globally and partner with industry, government and community to create high-value economic and social dividends is supported by the outstanding contribution of the Environment Institute. Institute members are tackling important research challenges around water, climate change resilience, adaptation and mitigation, biodiversity, conservation, marine biology, palaeontology and genetics.

This annual report highlights the strong multi-disciplinary research delivered by the Institute members, and their positive impacts. Good examples include the restoration of lost native oysters through the creation of Windara Reef and understanding South Australian coastal carbon opportunities to demonstrate how research can deliver societal benefits, including the development of solutions to biodiversity loss and climate change adaptation and mitigation. Fossils reveal insights into the country's prehistory and provide answers to help understand our native flora and fauna under future drying events. The development of laws in the Polar Regions can help achieve a sustainable balance between their use and protection of the environment for future generations.

I am pleased to note that 2018 was a strong year for Institute members in Australian Research Council grant schemes, with 6 Discovery Projects, 1 DECRA and 1 Future Fellowship. Members' contributions were also acknowledged through other awards including recognition by the South Australian Science Excellence Awards for the work of Professor Alan Cooper and his team to the Aboriginal Heritage Project and Dr Liz Reed in Science communication; and by the SA Climate Leaders Awards for Professor Seth Westra as a sustainability leader.

Professor Anton PJ Middelberg
Deputy Vice-Chancellor (Research)

Advisory Board Chair

I invite you to celebrate the achievements of the Environment Institute in 2018.

The Environment Institute works to develop and implement solutions to improve the health of the environment, the wellbeing of our community and to sustain our economy. The strength of the Environment Institute rests with the collective impact of the members, who bring together a unique range and diversity of perspectives to the research effort.

The Institute's work is as broad in scope as it is deep in discovery.

The Environment Institute has had an impressive year across the breadth of the research effort. As Chair of the Advisory Board, I continue to observe the research depth of the 20 Professorial Researcher Leaders and 49 members who come together to form the core of the Environment Institute. They exhibit an impressive work effort and an ongoing commitment to excellence in research, collaboration and engagement that is the core of the Environment Institute's strength.

The Institute's community outreach and public engagements are well supported. The contributions address areas such as adapting to a changing environment, sound management of our landscape and biosphere, and the promotion of population health and wellbeing.

As Chair, I believe one of the enduring strengths of the Environment Institute is to deliver outstanding research and engagement across a broad environmental range by bringing together leading researchers in a variety of fields. And it is from this diversity of experience that the collaborations continue to build a strong foundation for innovation and impactful research.

The Environment Institute continues to enjoy research success, with many of the highlights of 2018 centring around the research efforts. These highlights can be found on page 5.

I would like to thank all the Advisory Board members for their ongoing service to the Environment Institute. I would also like to welcome three new Advisory Board members: Professor Bruce Northcote, Director, Office DV&VP(R), Ms Elanie Bensted, Chief Executive of ZooSA and Professor Chris Daniels, Director Cleland Wildlife Park.

I would also like to acknowledge the dedication, hard work and commitment of the staff in the Institute. I particularly note the important leadership role that rests on the very able shoulders of the Director, Professor Bob Hill. Thank you for your ongoing and committed leadership Bob; you provide immeasurable support and guidance across the Environment Institute.

The Environment Institute has a continuing impact within the University of Adelaide and in the broader community, and we are all the better for the work of the members and the commitment of the staff.

I look forward to the challenges and opportunities the Environment Institute will approach in the year ahead.

Sandy Pitcher
Advisory Board Chair

Director

2018 was a year of major transition for the Environment Institute, mostly because I moved from being a very part-time Director to taking on the job full-time. I spent most of the year meeting people, talking about research opportunities, examining potential funding sources, and deciding where we could best apply our investments to maximise the return. Many of the initiatives that were put in place are long term and it will be some time before we see how successful they have been, but in the meantime Environment Institute members continued to excel.

The prizes and awards won by Environment Institute members are listed elsewhere, but I would especially like to highlight the exceptional quality of the publications produced by our members. We produced 44 papers in 2018 that were published in journals with an impact factor of 6 or above, and 9 with impact factors above 15. This is an extraordinary effort from our members and places them amongst the very best in the world.

The challenge now is to lift our research income to properly support our outstanding members. In a world where the massive impact of climate change is beginning to be broadly understood, our skill set has never been more important.

Professor Bob Hill
Director

COASTAL CARBON OPPORTUNITIES

Coastal vegetated ecosystems such as seagrass beds, mangroves and saltmarshes are extremely efficient at capturing carbon dioxide from the atmosphere. They are therefore considered a carbon 'sink' and a useful tool to combat climate change.

Carbon sequestered into these coastal ecosystems, referred to as 'blue carbon', is predominantly stored below ground in the sediment, with a smaller proportion stored in the above-ground vegetation (referred to as biomass). Of the three main blue carbon ecosystems, mangroves have the greatest above ground biomass and carbon storage capacity.

However, the above ground biomass and carbon pool of mangroves is generally poorly quantified and is highly variable within and across species and locations. Prior to this project there was no existing data on above ground mangrove biomass and carbon storage for South Australian mangrove forests.

A team of researchers from the *Environment Institute* led the 'Coastal Carbon Opportunities' project funded by the Goyder Institute (with co-funding from EI, Edith Cowan University and SA Water). This project set out to collect and analyse new field data from coastal carbon ecosystems in South Australia and to improve our understanding of the value the state's coastal carbon sinks. New methods were developed to measure the above ground biomass and carbon pool of mangroves in South Australia.

With support from Lendlease and the South Australian Department of Planning, Transport and Infrastructure, the team accessed part of the Northern Connector road construction site, where small areas of *Avicennia marina* (the only mangrove in South Australia) were permitted to be removed to make way for a bridge. This unique opportunity enabled researchers not only to obtain estimates of biomass calculated via traditional field-based forestry techniques and new methodology using drones, but to also obtain true measurements of biomass directly from the felled trees.

The project demonstrated proof-of-concept for the use of imagery collected by a drone to build 3D models of mangroves to estimate above-ground biomass. Field based methods identified that critical predictors of tree biomass for South Australian mangroves were tree height and trunk diameter. The researchers used drone-based canopy measurements to develop methods to predict the variables necessary to estimate above ground biomass.

These methods are being refined at a new field site in Mutton Cove, South Australia, to allow for measurements across greater scales than are feasible, using traditional field-based methods. The outcomes from this project can support the development of novel tools for assessing coastal carbon sequestration and emissions abatement opportunities in South Australia and beyond.

In a report to the Goyder Institute, the research team consisting of Dr Alice Jones, Dr Ramesh Raja Segaran, Professor Michelle Waycott and Professor Bronwyn Gillanders provided data to fill critical knowledge gaps around carbon in coastal ecosystems. This included the development of novel methods for measurement, which will support the development of climate strategies and policies within state government and the Goyder Institute.

Further reading

Jones, A. R., Raja Segaran, R., Waycott, M. & Gillanders, B.M. (2019). Coastal Carbon Opportunities: Using drones to measure mangrove above-ground biomass. *Goyder Institute for Water Research Summary Report* Series No. 19/13.

Jones, A. R., Raja Segaran, R., Clarke, K., Waycott, M., Goh, W. S. H. & Gillanders, B. M. (in review). Estimating mangrove tree biomass and carbon content: a comparison of forest inventory techniques and drone imagery, *Frontiers in Marine Science*.

Clockwise from top left:

Students Sidney Heitmann, Joseph Widdrington and Tiahni Adamson amongst the mangroves onsite at Mutton Cove, South Australia;

Fieldwork at Mutton Cove, South Australia, collecting drone imagery and validation data for mangrove biomass estimation, featuring student Tiahni Adamson;

Researchers Dr Alice Jones and Po-Yun Wong piloting a flight for drone-based estimates of mangrove biomass;

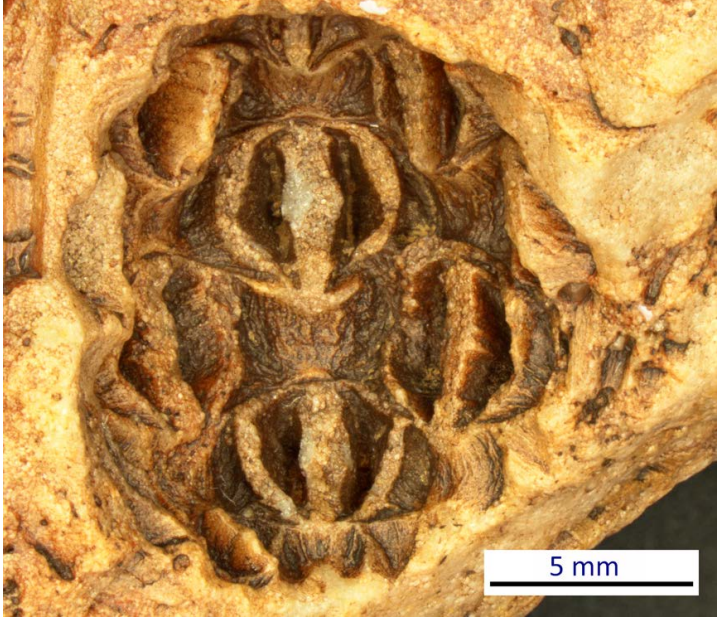
Researcher Dr Ramesh Raja Segaran working on the sensor systems used to collect drone-based imagery for estimating mangrove biomass.

THE STUART CREEK FOSSIL FLORA: AN INSIGHT INTO AUSTRALIA'S VEGETATION HISTORY

The south-eastern quarter of Australia contains a large number of fossil plant localities that provide important information about the evolution of the living Australian vegetation. Most of these fossils were deposited under extremely wet conditions. They represent parts of the major rainforests that flourished in southern Australia when there was a land connection to Antarctica, and Australia was about 20° further south than its current location.

These fossil sites are extremely important, but they tell only part of the story. Researchers have been seeking fossil deposits that provide information about how the vegetation responded when Australia began to dry out, more than 20 million years ago. Through this drying period fossil deposition became much less likely, as abundant water is usually a prerequisite for fossilisation.

During the 1970s a set of silcrete deposits in south-central Australia came to prominence under the leadership of Dr Bob Lange, a member of the Botany Department at the University of Adelaide. A site of significance was found at Stuart Creek, South Australia, where a diverse array of leaves, seeds and fruits were preserved. However, this site has not received the prominence it deserves as it has proved to be difficult to date accurately.



AS A RESULT OF DR CALLEN'S RECENT RESEARCH, THE AGE OF THE SILCRETES HAS BEEN TIGHTENED CONSIDERABLY AND IS NOW REGARDED AS BEING MID-MIOCENE TO EARLY PLIOCENE AND MOST LIKELY LATE MIOCENE (ABOUT 12 TO 5 MILLION YEARS AGO).

A few years ago, the *Environment Institute* Director, Professor Bob Hill, met with Dr Lange who agreed to donate his Stuart Creek collection to the South Australian Museum. This collection was then borrowed by the University of Adelaide, and over the past three years hundreds of hours of meticulous work has been undertaken to catalogue the collection. Research has been embarked upon to revise the age of these silcretes.

The *Environment Institute* provided support to Dr Roger Callen, an author on the original paper in Nature in 1979 which set the parameters for the age of the Stuart Creek silcretes. As a result of Dr Callen's recent research, the age of the silcretes has been tightened considerably and is now regarded as being mid-Miocene to early Pliocene and most likely late Miocene (about 12 to 5 million years ago). A visiting international scientist Dr Sung Soo Whang, from Chonbuk National University, South Korea, spent 12 months painstakingly preparing some of the fossils for publication. Dr Whang's techniques included using fine needles to carefully remove the "desert varnish" from specimens to reveal the best possible details of the fossil. His work was followed by 12 months of dedicated work by volunteer, Ronda Atkinson, who recorded every specimen and made silicon casts of hundreds of them.

Through this active research the Stuart Creek fossil flora is expected to reveal many important aspects of how the Australian vegetation responded to the drying of the Australian continent, resulting in our current unique, dry-adapted vegetation.

Further reading

Hill, R. S., Tarran, M. A., Hill, K. E., & Beer, Y. K. (2018). The vegetation history of South Australia. *Swainsona*, 30, 9-16.

Above left:

A cast of a cone of Gymnostoma, *which today is the tropical version of the iconic Australian family Casuarinaceae. The presence of* Gymnostoma *at Stuart Creek strongly suggests that rainfall there was much higher than today.*

Above right:

A single divided leaf that is similar to many species of the iconic Australian arid zone tree Brachychiton, *which includes the spectacular Illawarra Flame Tree, and is an iconic Australian plant.*

Facing page:

An exposed surface of the Stuart Creek silcrete taken in the field in the late 1970s. The dense packing of many different species of leaves is clearly visible.

Clockwise from top left:

Professor Connell counting newly recruited baby oysters on Windara Reef:

The extremely dense recruitment of baby oysters to the reef provides great optimism for their successful restoration;

University of Adelaide students battle the elements to help identify the preferred substrate for the native oyster.;

The research dive team ready to launch from Ardrossan boat ramp to explore Windara Reef.

RESTORING AUSTRALIA'S LOST NATIVE OYSTER REEFS

Flourishing in the coastal waters of Gulf St. Vincent near Ardrossan, Windara Reef is the first large-scale experiment to restore native oyster reefs in Australia.

Over 150 years ago, extensive oyster reefs carpeted the seafloor throughout our gulfs and across 1,500 km of South Australian coastline. These ecosystems provided the foundations for a rich and productive marine environment but were almost lost to post-colonial oyster fisheries. Today, Windara Reef presents an incredible attempt to return Australian Flat Oysters (*Ostrea angasi*) to South Australia's coast, restoring their role in cleaning coastal waters and boosting fish populations.

The Windara Reef project covers 20-hectares of seafloor and consists of 150 limestone boulder reefs, varying from 10 to 30 meters long. These reefs provide the essential rocky foundations on which the oyster habitat can grow. Prior to construction, there was little known about the local ecology of the native Flat oysters, and *Environment Institute* researchers Professor Sean Connell and Dr Dominic McAfee recognised key questions that needed answering:

- When do they breed?
- What is their preferred substrate to live on?
- Are there enough baby oysters in the water to restore a reef?

Since its construction two years ago, the team has learnt a lot about how to restore such a delicate ecosystem. This included discovering that these native oysters have two distinct spawning events each year, releasing potentially millions of larval baby oysters, seeking a place to live. Understanding the timing of oyster spawning allowed researchers to "capture" these spawning events, by laying their preferred substrate when the greatest number of baby oysters were looking for a home.

It soon became clear that in order for oysters to return in abundance, researchers would need to tackle an unwelcome reef occupant: turf algae. A thick layer of turf algae smothered the reef foundations within weeks of its construction, forming a barrier that prevented baby oysters from settling on the reef. To reduce turf cover and help baby oysters access the reef, natural and artificial kelp canopies were constructed on the reef to provide suitable conditions for baby oysters to settle. Within months the kelp canopies had boosted oyster settlement atop the reef substrate by up to 40 times. Scaling this extraordinary research may reduce the time required to restore oyster habitat on Windara Reef and inform how future reefs should be restored.

A surprising outcome of this restoration project has been recognising the motivational force of environmental optimism, which helps engage people with environmental conservation. Positivity surrounding this restoration project encouraged multiple stakeholders to work together to make it a success. Using the principles of conservation psychology, Professor Connell and Dr McAfee are exploring how environmental optimism can be used to improve public and industry engagement with conservation projects. They have also explored how to turn research on environmental loss into environmental solutions, providing a pathway for generating public support to restore future oyster reefs.

The Windara Reef project is a partnership between The University of Adelaide, the Nature Conservancy, the Australian Government, the South Australian Government, the Yorke Peninsula Council and the Ian Potter Foundation.

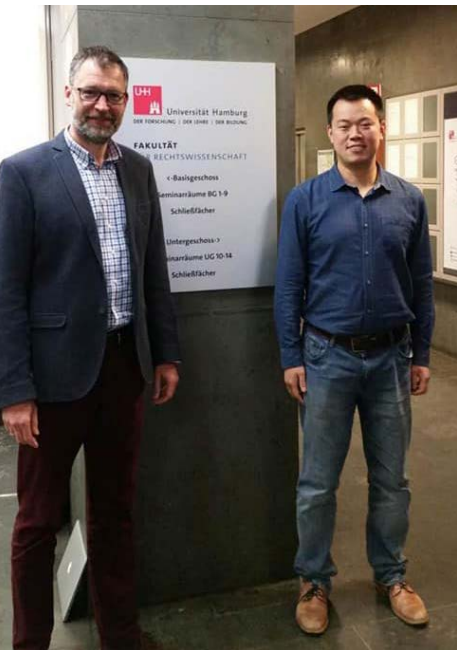
Further reading

McAfee, D., Doubleday, Z.A., Geiger, N., & Connell, S.D. (2019). Everyone loves a success story: optimism inspires conservation engagement. *BioScience*, 69(4), 274-281.

McAfee, D., Alleway, H.K., & Connell, S.D. Environmental solutions sparked by environmental history. *Conservation Biology*, in press.

CONSERVATION OF MARINE LIVING RESOURCES IN THE POLAR REGIONS

"The Polar Regions are facing unprecedented challenges from human-induced climate change. The future development of Polar Law presents an opportunity for the international community to work together to determine how best to achieve a sustainable balance between use and protection of the environment."
says Dr Nengye Liu, Senior Lecturer, Adelaide Law School and Environment Institute member.



The Polar Regions (Arctic and Antarctica) are 'Final Frontiers' of human activity. While the world's oceans face extreme pressure from anthropogenic (human-induced) activities, the Polar Regions remain relatively pristine. Nevertheless, marine ecosystems in the Polar Regions are experiencing significant changes due to global warming, ocean acidification, changes in sea-ice distribution and increasing human activities. There is an urgent need for an effective governance framework for marine living resources in the Polar Regions to avoid the degradation of these shared resources due to collective self-interest, a 'Tragedy of the Commons'.

Against this backdrop, the Environment Institute's Dr Nengye Liu, a Senior Lecturer at the Adelaide Law School, examines the state and adequacy of the existing international legal regimes for the conservation of marine living resources in the Arctic and Antarctica. Dr Liu produced a comprehensive assessment of the 2018 Agreement to Prevent Unregulated High Seas Fisheries in the Central Arctic Ocean.

For example, since 2015, meetings on regulating high sea fisheries in the Central Arctic Ocean have been held on a number of occasions. Key high sea fishing entities, such as China, the European Union, Japan and the Republic of Korea were all invited by Arctic States to engage within a broader process toward the prevention of unregulated commercial fishing in the central Arctic Ocean. Dr Liu's research shed light on geopolitical struggles behind the negotiations on the establishment of marine protected areas (MPAs) in the Southern Ocean. His findings aim at generating effective legal systems to achieve sustainable conservation, management and exploitation of marine living resources in the Polar Regions. This will ensure the preservation of the Polar marine ecosystems for their intrinsic worth and also for the many ecosystem services they provide.

Dr Liu's research was funded by Australia-Germany Joint Research Scheme (2017-2018), Australia-CASS (China) Joint Action Program (2018) and Australian Institute of International Affairs (2018). Working with leading teams from University of Hamburg

and Chinese Academy of Social Sciences, to deliver high impact outcomes. His research has been covered by mainstream media such as ABC, BBC, Strait Times and Xinhua. Building upon above success, Dr Liu was awarded an Australian Research Council Discovery Grant "Geopolitical Changes and the Antarctic Treaty System" (2019-2021), with a group of Australia's most prominent international law and relations scholars.

Further reading

Liu, N. (2018). The European Union and the Establishment of Marine Protected Areas in Antarctica, *International Environmental Agreements: Politics, Law and Economics*, 18(6), 861-874.

Liu, N. & Brooks, C. (2018). China's Changing Position towards Marine Protected Areas in the Southern Ocean: Implications for Future Antarctic Governance, *Marine Policy*, 94, 189-195.

Nengye, L., Brooks, C. & Qin, T. (Eds.) (2019). Governing Marine Living Resources in the Polar Regions. *Cheltenham: Edward Elgar*.

McGee, J. & Liu, N. (Eds) (2019). Special Issue "The Challenges for Antarctic Governance in the Early Twenty-First Century". *Australian Journal of Maritime and Ocean Affairs*, 11(2).

Liu, N. (2019). The Rise of China and the Antarctic Treaty System. *Australian Journal of Maritime and Ocean Affairs*, 11(2), 120-131.

Schatz, V., Proelss, A. & Liu, N. (2019). The 2018 Agreement to Prevent Unregulated High Seas Fisheries in the Central Arctic Ocean: a Critical Analysis. *International Journal of Marine and Coastal Law*, 34(2), 195-244.

THERE IS AN URGENT NEED FOR AN EFFECTIVE GOVERNANCE FRAMEWORK FOR MARINE LIVING RESOURCES IN THE POLAR REGIONS TO AVOID THE DEGRADATION OF THESE SHARED RESOURCES DUE TO COLLECTIVE SELF-INTEREST, A 'TRAGEDY OF THE COMMONS'.

Above:

Dr Liu convened AIIA Workshop "Exploring Australia's China Strategy in Antarctic Governance", 7 November 2018, University of Adelaide

Facing page:

Dr Liu with Prof Alexander Proelss, Chair of Public International Law, Faculty of Law, University of Hamburg.

INSTITUTE ENGAGEMENT

Media Releases

DATE	MEDIA RELEASE	ENVIRONMENT INSTITUTE MEMBER
10 Jan	Climate change drives collapse in marine food webs	Prof Ivan Nagelkerken & Assoc Prof Damien Fordham
5 Feb	Basin experts call for action on the Murray-Darling	Prof Sarah Wheeler
13 Feb	Middle Earth preserved in giant bird dung	Australian Centre for Ancient DNA
14 Feb	#EpicDuckChallenge shows we can count on drones	Dr Ramsh Raja Segaran & Prof Lian Pin Koh
20 Feb	Helping young Australians become future leaders	Australian Centre for Ancient DNA
16 Mar	Celebrating Earth Hour with citizen science day	Prof Frank Grutzner
4 Apr	Island emus' size related to size of island homes	Dr Vicki Thomson
3 May	Weeds take over kelp in high CO2 oceans	Prof Ivan Nagelkerken, Prof Sean Connell & Dr Zoe Doubleday
8 May	Experimentation essential in saving Earth's degraded land	Prof Andy Lowe
17 May	Explaining the history of Australia's vegetation	Dr Francesca McInerney
14 Jun	Platypus venom inspires potential new diabetes treatments	Prof Frank Grutzner
10 Jul	Farming fish alter 'cropping' strategies under high CO2	Prof Ivan Nagelkerken & Prof Sean Connell
10 Jul	Towards winning the war on feral wild rabbits	Prof Phill Cassey & Dr Damien Fordham
31 Jul	Australia facing increased intense rainstorms	Prof Seth Westra
13 Aug	Geologist Richard Hillis is SA Scientist of the Year	Dr Liz Reed
12 Sep	Wombat conference focuses on Aussie cultural icon	Michael Swinbourne
3 Oct	Lilly Pilly fossils reveal snowless Snowy Mountains	Dr Myall Tarran & Prof Bob Hill
27 Nov	Climate change wiped out the 'Siberian unicorn'	Australian Centre for Ancient DNA
27 Nov	Rethinking Australia's climate history	Assoc Prof John Tibby
28 Nov	$13.8 million research win for University of Adelaide	Assoc Prof John Tibby

Photo: Shannon MacDonnell

South Australian Natural Resource Management Science Conference

The 2018 South Australian Natural Resource Management Science Conference showcased the science behind environmental decision making, policy and management in South Australia. Building on the success of the first two conferences, the theme was *Science for Policy in a Changing World*.

The following are Environment Institute members who presented at the conference.

DATE	SPEAKER	DESCRIPTION
10 April	Prof Kristofer Helgen	Keynote: How little we know of nature: the thrill of scientific discovery in an uncertain world
	Prof Sarah Wheeler	Panel – Adapt, migrate or transform: What are the options for SA in a changing climate? Leaving the farm: exploring the drivers of farm exit over time in the Murray-Darling Basin
	Dr Liz Reed	Using the past to save the future: the role of the 'recent' fossil record in biodiversity conservation
	Jessie-Briar Treloar	Small mammals from the Naracoorte Cave fossils: how to use their past for their future
	Dr Zoe Doubleday	Testing the globally accepted limits of hypoxia: physiological effects of long-term exposure in freshwater fish
	Prof Wayne Meyer	Why do NRM regional planning processes and tools have limited effect?
	Dr Alice Jones	Blue carbon in South Australian coastal vegetated ecosystems
	Dr Molly Hennekam	Drones for conservation
	Dr Graeme Riddell	CASCADE – Collaborative Analysis for Secure, Alternative, Affordable Energy, tools to support viability assessment of waste to energy projects
	Dr Jasmine Packer	Co-designed priorities, based on habitat suitability mapping, improves conservation planning for threatened populations in patchy habitats
	Dr Nicole Foster	Mapping change in mangrove communities for Carbon sequestration using SA Land Cover
	Briony Chamberlayne	Using bivalve geochemistry to investigate environmental baseline characteristics of the RAMSAR listed Coorong wetland
11 April	Prof Sean Connell	Conservation psychology: the duality of optimism and pessimism
	Tahlia Perry	EchidnaCSI: using Citizen Science and Molecular Biology for Conservation
	Dr Thomas Prowse	Overabundant icons: kangaroo population trends and models for South Australia
	Dr Graeme Riddell	Co-designing a disaster risk reduction decision support system for integrated long-term natural hazard mitigation planning
	Prof Bronwyn Gillanders	Developing knowledge and tools to inform integrated marine management: Ports and shipping in Spencer Gulf as a case study
	Michael Swinbourne	Management of southern hairy-nosed wombats (Lasiorhinus latifrons) in South Australia: what is the real state of affairs?
	Grace Porter-Dabrowski	A multi-scale and multi-method approach to assessing Southern Hairy-nosed Wombat population and abundance in the Murraylands, South Australia
	Amelie Jeanneau	Remote sensing applications for soil erosion modelling in South Australian agricultural landscapes
	Dr Douglas Bardsley	Thresholds in bushfire risk perception in South Australia

ARC FUNDING OUTCOMES

TYPE	ANNOUNCED	EI INVESTIGATOR(S)	AIM OF PROJECT
Discovery Project	6	Dr Christian Huber	To develop a new analytical framework to build detailed genomic maps of speciation genes across different taxa, to determine whether observed speciation is the result of background selection and demography alone, or whether there are actual barriers to gene flow and introgressed DNA.
		Dr Bastien Llamas	To use DNA sequencing technologies to generate the first complete and accurate Aboriginal genomes, along with maps of genomic variation around Australia.
		Prof Peng Bi	To estimate the economic loss of workplace heat exposure in Australia and assist in the development of workplace heat policies, and inform resource allocation to make Australian workplaces well prepared for likely increasing extremely hot weather.
		Assoc Prof John Tibby & Dr Jonathan Tyler	To document climate variability in eastern Australia over the Holocene, the last 11,500 years to improve decision making capacity for natural resource management, and planning.
		Prof Christian Doonan & Prof Christopher Sumby	To uncover important chemical knowledge regarding small molecule activation by reactive metal species that are site-isolated and stabilised within the pores of metal-organic frameworks. The outcomes of this project will inform the design of the next-generation catalysts for conversion of methane to methanol, a potential fuel, and facilitate the transition to a clean energy future.
		Prof Michelle Waycott	To study the sundew bug and sundew insect-plant interactions to determine if insects and plants co-evolve or if they diversify by other evolutionary processes to showcase the evolution and uniqueness of Australia's native biota.
Discovery Early Career Researcher Award	1	Dr Raymond Tobler	To further advance work on the genetic history of Indigenous Australians and Papuans to produce a detailed picture of genomic adaptation in Indigenous Australians and Papuans and creating a comprehensive genetic history of the First Peoples of Sahul.
Future Fellowship	1	Dr Laura Weyrich	To explore the history and origin of 'Industrial' diseases such as obesity, diabetes, heart disease and autism.

Sundew *(Drosera rotundifolia)*

AWARDS AND ACHIEVEMENTS

Congratulations to Environment Institute members

Channel 9 Young Achiever's STEM award

Phd student Jenna Crowe-Riddell was a finalist in the Channel 9 Young Achievers STEM Award. These awards highlight and award young people for significant contributions in their categories. Jenna is currently completing her PhD with the *Environment Institute*'s Dr Kate Sanders on the senses of sea snakes. A high achieving student, Jenna was a Fulbright scholar in 2016, 2017 SA Fresh Scientists and her work has been covered in *Science Daily, Australian Geographic* and *Cosmos Magazine*.

Jenna Crowe-Riddell

SA Science Awards Excellence

SA Science Awards in Excellence showcases South Australia's best in its science community.

Congratulation to Dr Liz Reed who won the 2018 Unsung Hero of South Australia Science Communication. Dr Reed's research involves the study of cave deposits in the South East region of South Australia, Nullarbor and Tasmania. She is particularly interested in reconstructing past environments and biodiversity from cave deposits, and also the processes that lead to fossil accumulation.

Congratulations to the Aboriginal Heritage Project, partnership between the local members of the Aboriginal community, the SA Museum, Australian Centre for Ancient DNA and the University of New South Wales SA who were the recipient of the SA Science Awards Excellence in Research Collaboration.

Other *Environment Institute* finalists included:

SA Science Awards Excellence in Research Collaboration: Shellfish Restoration Project, at Windara Reef, partnership between the University of Adelaide, South Australian Government (Department for Environment and Water, Primary Industries South Australia, The Nature Conservancy, The Australian Government, the Yorke Peninsula Council, The Ian Potter Foundation, and the Australian Research Council). Featured on page 12 of this annual report.

Shellfish Restoration Project group: AusOcean Founder Alan Noble, Former Chief Scientist Leanna Read, DEW Program Principal Marine Parks Simon Bryars, University of Adelaide Professor of Ecological and Environmental Science Sean Connell, DEW Marine Parks Scientific Officer Jamie Hicks, Stage 1 Construction Former Project Manager Sarah-Lena Reinhold, PIRSA Aquaculture Policy and Environment General Manager Heidi Alleway, DEW Science and Information Group Executive Director Sandy Carruthers, Project Coordinator, The Nature Conservancy Anita Nedosyko, University of Adelaide Marine Science Postdoctoral Fellow Dominic Mcaffee, Minister for Industry and Skills David Pisoni, Science and Information Strategy and Communications Manager Corri Baker, PIRSA Fisheries and Aquaculture Executive Director Sean Sloan and PIRSA Fisheries Reform Manager Jon Presser.
Source: Department for Industry and Skills South Australia

Above left: Dr Liz Reed accepting her 2019 Unsung Hero of South Australia Science Communication award. Source: Department for Industry and Skills South Australia: Above right: Aboriginal Heritage Project accepts Excellence in Research Collaboration award. Source: Department for Industry and Skills South Australia

Barbara Kidman Women's Fellowship

Dr Michelle Lim was announced as a 2018 recipient of the Barbara Kidman Women's Fellowship. The fellowship provides support to female academics to enhance and promote their degree. This is the third consecutive year that an *Environment Institute* member has been awarded this fellowship.

Dr Michelle Lim

SA Climate Leaders Award 2018

The *Environment Institute* was well represented at the 2018 SA Climate Leaders Award. The awards acknowledge achievements of those that take action to address climate change in South Australia. Dr Manuel Solis was recognised as a finalist in the 'Individual Category' and Professor Bronwyn Gillanders, with the Goyder Institute, were finalist in the 'Government Category'. Professor Seth Westra, a leader in sustainability and climate risk, was announced as the winner of the 'Individual Category'.

Dr Manuel Solis

Professor Seth Westra

Zoos South Australia Board

Congratulations to Professor Kris Helgen who was elected as a new member on the Zoos SA Board. Professor Helgen is an expert on mammal evolution and conservation, and Deputy Director Centre for Applied Conservation Science. He is sure to make a valuable and lasting contribution to the Board.

Professor Kris Helgen

CITATION STATISTICS

RESEARCHER	NUMBER OF CITATIONS IN 2018	H-INDEX	I10-INDEX
Dr Lee Arnold	534	27	44
Prof Andrew Austin	705	49	161
Assoc Prof Jeremy Austin	580	37	72
Dr Doug Bardsley	194	20	30
Dr Simon Baxter	540	33	45
Prof Peng Bi	811	39	96
Dr Martin Breed	356	16	21
Prof Alan Collins	1388	47	114
Prof Justin Brookes	716	40	77
Assoc Prof Phill Cassey	1177	43	149
Prof Sean Connell	1318	59	141
Prof Alan Cooper	2491	78	191
Prof Steven Cooper	524	40	99
Dr Georgina Drew	25	6	3
Prof Stephen Donnellan	694	43	116
Prof Christian Doonan	1599	37	73
Dr Juraj Farkas	120	10	10
Dr Damien Fordham	387	25	52
Dr Diego Garcia-Bellido	208	22	39
Prof Bronwyn Gillanders	1147	55	133
Prof Frank Grutzner	477	33	53
Prof Kristofer Helgen	960	36	98
Prof Bob Hill	382	53	166
Prof Megan Lewis	225	22	33
Prof Andy Lowe	1324	53	141
Dr Michelle Lim	13	5	1
Dr Nengye Liu	13	4	2
Prof Holger Maier	1668	55	179

Hydrophis peronii. Photo: James Nankivell

Dr Francesca Mcinerney	405	17	20
Prof Ivan Nagelkerken	1169	56	120
Assoc Prof Melissa Nursey-Bray	161	16	27
Assoc Prof Bertram Ostendorf	248	25	46
Dr Liz Reed	13	9	7
Dr Frank Reith	412	25	45
Dr Kate Sanders	298	20	27
Dr Emma Sherratt	211	13	16
Prof Nigel Spooner	344	32	68
Prof Christopher Sumby	502	29	62
Assoc Prof Yan Tan	205	15	23
Dr John Tibby	200	28	52
Dr Vicki Thomson	49	6	6
Dr Jonathan Tyler	143	15	15
Prof Michelle Waycott	1459	43	79
Prof Sarah Wheeler	283	22	42
Prof Philip Weinstein	747	45	158
Prof Seth Westra	777	26	45
Dr Laura Weyrich	379	17	19

ENVIRONMENT INSTITUTE ADVISORY BOARD MEMBERS

Ms Sandy Pitcher (Chair)
Chair, Environment Institute Advisory Board

Sandy has worked at senior levels of the public sector in South Australia, the Australian government and the United Kingdom. She recently ended a three-year term as the Chief Executive of the Department of Environment, Water and Natural Resources in the South Australian government. Sandy has a strong background in climate change, renewable energy and is serving on a range of boards, including Solar Citizens and Climate Knowledge Innovation Community – Australia. Sandy is a graduate of the University of Adelaide, a Fellow of the Institute of Public Administration Australia, Graduate of the Australian Institute of Company Directors and was the national Telstra Businesswoman of the Year, Community and Government in 2012.

Professor Bob Hill
Director, Environment Institute

Bob is the Director of the Environment Institute. He is best known for his research on the fossil history of Nothofagus and southern conifers, and has won awards for his research on the impact of climate-change on Australian vegetation. He has published more than 125 refereed journal papers, 35 book chapters, several symposium papers and has edited or co-edited four books.

Professor Bronwyn Gillanders
Deputy Director, Environment Institute

Bronwyn is the Deputy Director of the Environment Institute. She is a prominent marine scientist with a strong focus on fish and cephalopods and environmental issues. She has more than 150 publications which have been cited over 11,000 times. She regularly interacts with government and industry for research. She is the current President of the World Council of Fisheries Societies and a past President of the Australian Society for Fish Biology.

Professor Julie Owens
Deputy Vice Chancellor (Research), University of Adelaide

Julie is the Pro Vice-Chancellor (Research Strategy). She is internationally eminent in the research areas of pregnancy, regulation of placental and foetal growth and the developmental origins of health and disease. She has a deep understanding of research strategy, with considerable experience in managing major research collaborations, generating prestigious outputs, and attracting research funding. She has also had valuable involvement in national and international competitive research peer review, with the ARC College of Experts, the NHMRC Academy and various grant and fellowship panels.

Ms Sandy Carruthers
Director of Science, Department of Environment, Water and Natural Resources

Sandy is the Director of Science for the Department of 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 and the Environment Institute Board.

Prof Bruce Northcote

Pro Vice-Chancellor (Research Engagement), Division of Research & Innovation

Bruce is Pro Vice-Chancellor (Research Engagement) within the Division of Research & Innovation at the University of Adelaide. He is also CEO of TelAri Analytics – a commercial spin out from research in his previous role as Director of the Teletraffic Research Centre and the Centre for Defence Communications Information Networking. In those roles he brought his considerable private industry communications engineering consulting experience to the Defence sector.

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.

Prof 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 Adelaide University in 2018.

Photo: Liz Reed

OUR LEADING MEMBERS

MANAGEMENT COMMITTEE

Professor Bob Hill
Director, Environment Institute

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

MEMBERS

Adelaide Law School
Dr Michelle Lim
Dr Nengye Liu
Dr Manny Solis

Anthropology and Development Studies
Dr Georgina Drew

Biological Sciences
Professor Alan Cooper
Director, Australian Centre for Ancient DNA

Associate Professor Jeremy Austin
Deputy Director, Australian Centre for Ancient DNA

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 Frank Grutzner
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

Associate Professor Bertram Ostendorf
Associate Professor Phill Cassey
Director, Centre for Applied Conservation Science

Dr Simon Baxter
Dr Martin Breed
Dr Damien Fordham
Dr Diego Garcia-Bellido
Dr Francesca McInerney
Dr Frank Reith
Dr Kate Sanders
Dr Emma Sherratt
Dr Vicki Thomson
Dr Laura Weyrich

Civil, Environmental and Mining Engineering
Professor Holger Maier
Professor Seth Westra

Geography, Environment and Population
Associate Professor Melissa Nursey-Bray
Associate Professor Yan Tan

Global Food and Resources
Professor Sarah Wheeler

Physical Sciences
Professor Christian Doonan
Professor Alan Collins
Professor Christopher Sumby
Professor Nigel Spooner
Dr Lee Arnold
Dr Juraj Farkas
Dr Liz Reed
Dr Jonathan Tyler

Social Sciences
Associate Professor John Tibby
Director, Sprigg Geobiology Centre
Dr Doug Bardsley

Public Health
Professor Peng Bi

PARTNER MEMBERS

Professor Steven Cooper (Adjunct)
Principal Researcher, SA Museum

Professor Stephen Donnellan
Genetics and Evolution, SA Museum

Dr Giles Hamm
Honorary Fellow, SA Museum

Photo: Liz Reed

Photo: Kelvin Gaskin

SELECTED PUBLICATIONS

The following list comprises the top 20 Environment Institute publications from 2018 that have attracted attention. Environment Institute researchers are shown in bold type and articles are listed alphabetically by journal name.

Teeling, E.C., Vernes, S.C., Davalos, L.M., Ray, D.A., Gilbert M.T.P., Myers, E., **Bat1K Consortium***. (2018). Bat Biology, Genomes, and the Bat1K Project: To Generate Chromosome-Level Genomes for All Living Bat Species. *Annual Review of Animal Biosciences*, 6, m23-46.

**Bat1K Consortium includes Donnellan, S & Helgen, KM.*

Posth, C., Nakatsuka, N., Lazaridis, I., Skoglund, P., Mallick, S., Lamnidis, T. C., Rohland, N., Nagele, K., Adamski, N., Bertolini, E., Broomandkhoshbacht, N., **Cooper, A.**, Culleton, B.J., Ferraz, T., Ferry, M., Furtwangler, A., **Haak, W.**, Harkins, K., Harper, T.K., Hunemeier, T., Lawson, A.M., **Llamas, B.**,. . . Reich, D. (2018). Reconstructing the Deep Population History of Central and South America. *Cell*, 175(5), 1185-1197 e1122. doi:10.1016/j.cell.2018.10.027

Jevric, M., Petersen, A. U., Manso, M., Singh, S. K., Wang, Z. H., Dreos, A., **Sumby, C.**. . . Moth-Poulsen, K. (2018). Norbornadiene-Based Photoswitches with Exceptional Combination of Solar Spectrum Match and Long-Term Energy Storage. *Chemistry-a European Journal*, 24(49), 12767-12772. doi:10.1002/chem.201802932

Fagan-Jeffries, E. P., **Cooper, S. J. B.**, & **Austin, A. D.** (2018). Three new species of Dolichogenidea Viereck (Hymenoptera, Braconidae, Microgastrinae) from Australia with exceptionally long ovipositors. *Journal of Hymenoptera Research*, 64, 177-190. doi:10.3897/jhr.64.25219

Zhang, Y., Beggs, P. J., Bambrick, H., Berry, H.L., Linnenluecke, M.K., Trueck, S., Alder, R., **Bi, P.**. . . Capon, A.G. (2018). The MJA-Lancet Countdown on health and climate change: Australian policy inaction threatens lives. *Medical Journal of Australia*, 209(11), 474.

Butof, L., Wiesemann, N., Herzberg, M., Altzschner, M., Holleitner, A., **Reith, F.**, & Nies, D.H. (2018). Synergistic gold-copper detoxification at the core of gold biomineralisation in *Cupriavidus metallidurans*. *Metallomics*, 10(2), 278-286. doi:10.1039/c7mt00312a

Hodgson, J.C., Mott, R., Baylis, S. M., Pham, T.T., Wotherspoon, S., Kilpatrick, A.D., **Segaran, R.R.**. . . **Koh, L. P.** (2018). Drones count wildlife more accurately and precisely than humans. *Methods in Ecology and Evolution*, 9(5), 1160-1167. doi:10.1111/2041-210x.12974

Martin, H.C., Batty, E. M., Hussin, J., Westall, P., Daish, T., Kolomyjec, S., Piazza, P., Bowden, R., Hawkins, M., Grant, T., Moritz, C., **Grutzner, F.**. . . Donnelly, P. (2018). Insights into Platypus Population Structure and History from Whole-Genome Sequencing. *Molecular Biology and Evolution*, 35(5), 1238-1252. doi:10.1093/molbev/msy041

Goldenberg, S. U., **Nagelkerken, I.**, Marangon, E., Bonnet, A., Ferreira, C. M., & **Connell, S. D.** (2018). Ecological complexity buffers the impacts of future climate on marine consumers. *Nature Climate Change*, 8(3), 229-233. doi:10.1038/s41558-018-0086-0

Guerreiro, S.B., Fowler, H. J., Barbero, R., **Westra, S.**, Lenderink, G., Blenkinsop, S., . . . Li, X. F. (2018). Detection of continental-scale intensification of hourly rainfall extremes. *Nature Climate Change*, 8(9), 803-807. doi:10.1038/s41558-018-0245-3

Zscheischler, J., **Westra, S.**, van den Hurk, B. J. J. M., Seneviratne, S. I., Ward, P. J., Pitman, A., . . . Zhang, X.B. (2018). Future climate risk from compound events. *Nature Climate Change*, 8(6), 469-477. doi:10.1038/s41558-018-0156-3

Kosintsev, P., Mitchell, K. J., Deviese, T., van der Plicht, J., Kuitems, M., Petrova, E., Tikhonov, A., Higham, T., Comeskey, D., Turney, C., **Cooper, A.**,. . . Lister, A.M. (2019). Evolution and extinction of the giant rhinoceros *Elasmotherium sibiricum* sheds light on late Quaternary megafaunal extinctions. *Nature Ecology & Evolution*, 3(1), 31-38. doi:10.1038/s41559-018-0722-0

Johnson, R.N., O'Meally, D., Chen, Z.L., Etherington, G.J., Ho, S.Y.W., Nash, W.J., Grueber, C.E., Cheng, Y.Y., Whittington, C.M., Dennison, S., Peel, E., Haerty, W., O'Neill, R.J., Colgan, D., Russell, T.L., Attenbrow, D.E.A.P.V., Attenbrow, V., Bragg, J.G., Brandies, P.A., Chong, A.Y.Y., Deakin, J.E., Di Palma, F., Duda, Z., Eldridge, M.D.B., Ewart, K.M,. Hogg, C.J., Frankham, G.J., Georges, A., Gillett, A.K., Govendir, M., Greenwood, A.D., Hayakawa, T., **Helgen, K.M.**, . . . Belov, K. (2018). Adaptation and conservation insights from the koala genome. *Nature Genetics*, 50(8), 1102-1111. doi:10.1038/s41588-018-0153-5

Thomson, S.A., Pyle, R.L., Ahyong, S.T., Alonso-Zarazaga, M., Ammirati, J., Araya, J.F., Ascher, J.S., Audisio, T.L., Azevedo-Santos, V.M., Bailly, N., Baker, W.J., Balke, M., Barclay, M.V.L., Barrett, R.L., Benine, R.C., Bickerstaff, J.R.M., Bouchard, P., Bour, R., Bourgoin, T., Boyko, C.B., Breure, A.S.H., Brothers, D.J., Byng, J.W., Campbell, D., Ceriaco, L.M.P., Cernak, I., Cerretti, P., Chang, C.H., Cho, S., Copus, J.M., Costello, M.J., Cseh, A., Csuzdi, C., Culham, A., D'Elia, G., d'Acoz, C.D., Daneliya, M.E., Dekker, R., Dickinson, E.C., Dickinson, T.A., van Dijk, P.P., Dijkstra, K.D.B., Dima, B., Dmitriev, D.A., Duistermaat, L., Dumbacher, J.P., Eiserhardt, W.L., Ekrem, T., Evenhuis, N.L., Faille, A., Fernandez-Trianam, J.L., Fiesler, E., Fishbein, M., Fordham, B.G., Freitas, A.V.L,. Friol, N.R., Fritz, U., Froslev, T., Funk, V.A., Gaimari, S.D., Garbino, G.S.T, Garraffoni, A.R.S., Geml, J., Gill, A.C., Gray, A., Grazziotin, F.G., Greenslade, P., Gutierrez, E.E., Harvey, M.S., Hazevoet, .C.J., He, K., He, X.L., Helfer, S., **Helgen, K.M.**,. . . Zhou, H.Z. (2018). Taxonomy based on science is necessary for global conservation. *PLoS Biology*, 16(3). doi:ARTN e2005075 10.1371/journal.pbio.2005075

Ullah, H., **Nagelkerken, I.**, Goldenberg, S.U., & **Fordham, D.A.** (2018). Climate change could drive marine food web collapse through altered trophic flows and cyanobacterial proliferation. *PLoS Biology*, 16(1). doi:ARTN e2003446 10.1371/journal.pbio.2003446

Boast, A.P., **Weyrich, L.S.**, Wood, J.R., Metcalf, J.L., Knight, R. & **Cooper, A.** (2018). Coprolites reveal ecological interactions lost with the extinction of New Zealand birds. *Proceedings of the National Academy of Sciences of the United States of America*, 115(7), 1546-1551. doi:10.1073/pnas.1712337115

O'Connell, J.F., Allen, J., Williams, M.A.J., Williams, A. N., Turney, C.S.M., Spooner, N.A., . . . **Cooper, A.** (2018). When did Homo sapiens first reach Southeast Asia and Sahul? *Proceedings of the National Academy of Sciences of the United States of America*, 115(34), 8482-8490. doi:10.1073/pnas.1808385115

Bird, M.I., Beaman, R.J., Condie, S.A., **Cooper, A.**, Ulm, S. & Veth, P. (2018). Palaeogeography and voyage modeling indicates early human colonization of Australia was likely from Timor-Roti. *Quaternary Science Reviews*, 191, July 2018, 431-439.

Grafton, R. Q., Williams, J., Perry, C.J., Molle, F., Ringler, C., Steduto, P., Udall, B., **Wheeler, S.A.**,. . . Allen, R.G. (2018). The paradox of irrigation efficiency. *Science*, 361(6404), 748-750. doi:10.1126/science.aat9314

Nogues-Bravo, D., Rodriguez-Sanchez, F., Orsini, L., de Boer, E., Jansson, R., Morlon, H., **Fordham, D.A.**, & Jackson, S.T. (2018). Cracking the Code of Biodiversity Responses to Past Climate Change. *Trends in Ecology & Evolution*, 33(10), 765-776. doi:10.1016/j.tree.2018.07.005

FOR FURTHER ENQUIRIES

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