THE UNIVERSITY of ADELAIDE

Environment Institute

2016 Annual Report

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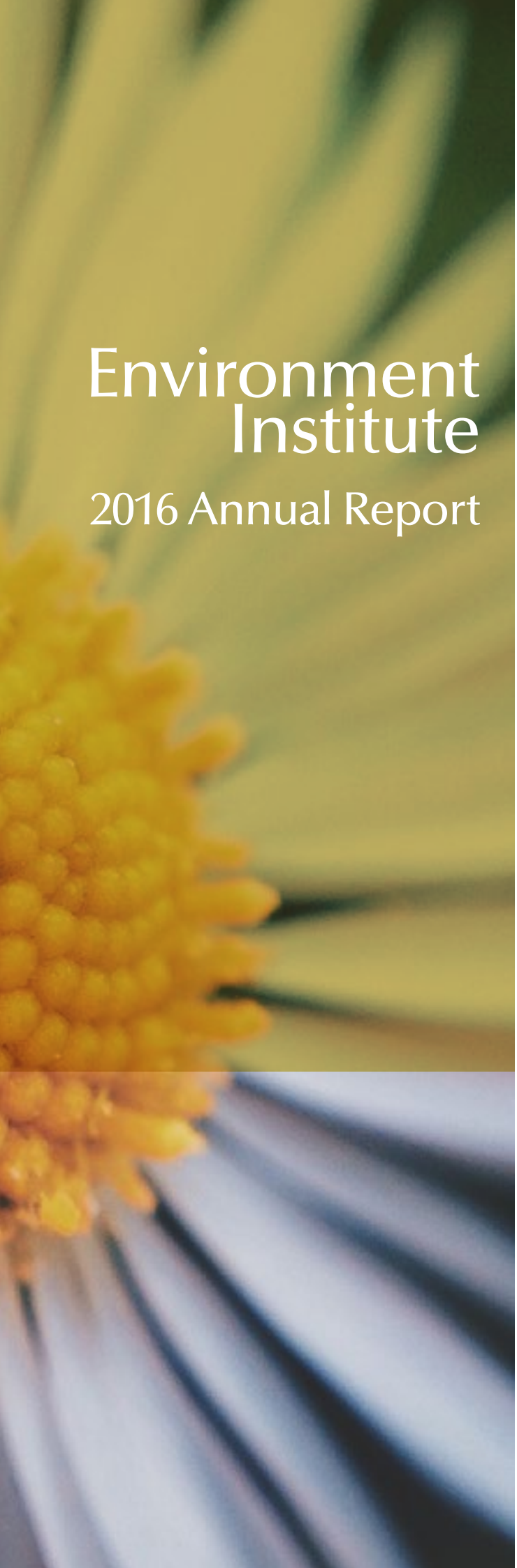


Environment Institute

2016 Annual Report

Contents

Vision

The Environment Institute exists to deliver outstanding research across environmental sciences. To enable this, it brings together leading water and climate scientists and researchers in fields including biodiversity, marine biology, landscapes and genetics.

By developing strong international collaboration and external engagement we can address complex future 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
- landscape transformation and restoration
- oceans and marine biology
- climate change, resilience and adaptation
- genetics, ancient DNA and DNA barcoding
- evolutionary biology

The Environment Institute is affiliated with the following programs:

- Australian Bioactive Compounds Centre (ABCC)
- Australian Centre for Ancient DNA (ACAD)
- Australian Centre for Evolutionary Biology and Biodiversity (ACEBB)
- Applied Conservation Science Centre
- Conservation Science and Technology (CCoST)
- Global Ecology Laboratory (GEL)
- Marine Biology Program (MBP)
- Spatial Science Research Group
- Sprigg Geobiology Centre (SGC)
- Water Research Centre (WRC)
- Landscape Futures Group

2016 at a glance

Australian Research Council Funding Outcomes

4 Linkage
3 Discovery
1 Centre of Excellence
1 Future Fellowship

Grant Income

Category 1	$5,342,764
Category 2	$3,833,836
Category 3	$1,787,711
Category 4	$2,427,945
Total grant income for 2016	**$11,392,257**

Publications

Our core group of 29 research leaders have produced the following publications in 2016:

294 Journal articles
2 Books
17 Conference papers
3 Expert reports to external bodies
1 Nature
1 Nature climate change

Highlights

Institute focus:

Develop and implement solutions to improve the health of the environment, our wellbeing and to sustain our economy. Key areas include uncovering how life has evolved on the Australian landmass, confronting environmental issues around sourcing and supply of clean water, and working to ensure the environment does not just co-exist with modern development, but thrives amongst the pressures of society.

2016 highlights:

- A new $600,000 artificial reef system is to be built south of Ardrossan, constructed from limestone, oyster shells and live native oysters. The construction of the new reef is set to bring about a raft of intergenerational economic, social and environmental benefits. The funding comes as result of research that uncovered that oyster reefs characterised much of South Australia's coastline from 1836 to 1910, forming one of the most widespread habitats for protein production, fisheries catch, biodiversity and filtration for water quality that sustain surrounding habitats.
- Research published in Nature showed that humans occupied Australia's arid interior and began developing sophisticated tools 10,000 years earlier than previously documented – around 49,000 years ago. The Warratyi rock shelter is about 550km north of Adelaide, in the Flinders Ranges. The findings from the cave show it to contain the oldest evidence of Aboriginal occupation in South Australia.
- The Environment Institute is part of a strategic partnership with global organisation Conservation International (CI) that will help boost conservation efforts in the Asia-Pacific region, including a global conservation drone program. The partnership is already achieving its goals, helping Timor-Leste develop a marine conservation program.
- We teamed up with South Australian food manufacturer Spring Gully Foods to investigate potential sources of food colourings among Australian native plants. The research will focus on arid zone plants known to be edible and with strong colours. These plants are often salt-tolerant and desert-adapted and grow abundantly throughout Australia.
- Our researchers helped convict National Forest timber thieves in a landmark case in the United States. DNA markers for certain trees were developed, this was used to create a DNA profiling reference which could be used in court proceedings.
- The Environment Institute sent a delegation to the Marrakech Climate Change Conference. Professor Andrew Lowe (Head of Delegation), Dr Manuel Solis (Deputy Head of Delegation), Professor Mike Young and Dr Charlie Hargroves attended key sessions related to their fields of expertise including water, environmental and city sustainability, disaster relief programs, and the Global Carbon Fund and its role in supporting low-emission and climate-resilient development pathways.

Aligning with South Australia's economic priorities

The State Government has developed ten economic priorities for South Australia's future. These priorities are areas where the State Government believes that it can make the most difference to the lives of everyday working people and to the future prosperity of our State.

The Environment Institute is engaged in several of these and will work to increase engagement in the future. We can demonstrate strong engagement in:

Unlocking the full potential of South Australia's resources, energy and renewable assets

The Environment Institute has a strong positive role to play in assisting our State in this priority.

For example, the marine investigations as part of the Spencer Gulf Ecosystem Development Initiative provides industry with credible evidence-based development options, while the restoration of Australia's native oyster reefs seek to reinstate one of the most widespread habitats for fisheries catch, biodiversity and filtration for water quality. Both of these initiatives aim to protect the quality of our seafood exports.

We undertake critical research in marine environments, including the ground-breaking research on the Spencer Gulf cuttlefish population, and the plan to reverse the wholesale loss of oyster reefs, which once sustained fisheries catch, water quality and surrounding habitats.

Premium food and wine produced in our clean environment and exported to the world

Projects involving local revegetation strategies that enhance the presence of useful orchard pollinators will optimize and enhance South Australia's $54 million dollar apple and pear industry. We have established a collaboration with Spring Gully foods under the Australian Governments Entrepreneurs Program to explore potential food colouring from native plants.

The Knowledge State—attracting a diverse student body and commercialising our research

The world-class research carried out by staff within the Environment Institute is a strong attractor of international students and staff to Adelaide, to work in both the long and short term on cutting edge research.

South Australia—a growing destination choice for domestic and international travellers

Much of our research is focused on areas of great interest to the tourism market. For example, we work very closely with the South Australia Museum on the world famous Warratyi rock shelter fossil site in the Flinders Ranges, the Kangaroo Island Cambrian fossil site and the UNESCO World Heritage listed Naracoorte Caves.

Our research this year highlighted the long connection Indigenous Australians have with the land though a study of Ancient DNA contained in ancient hair samples.

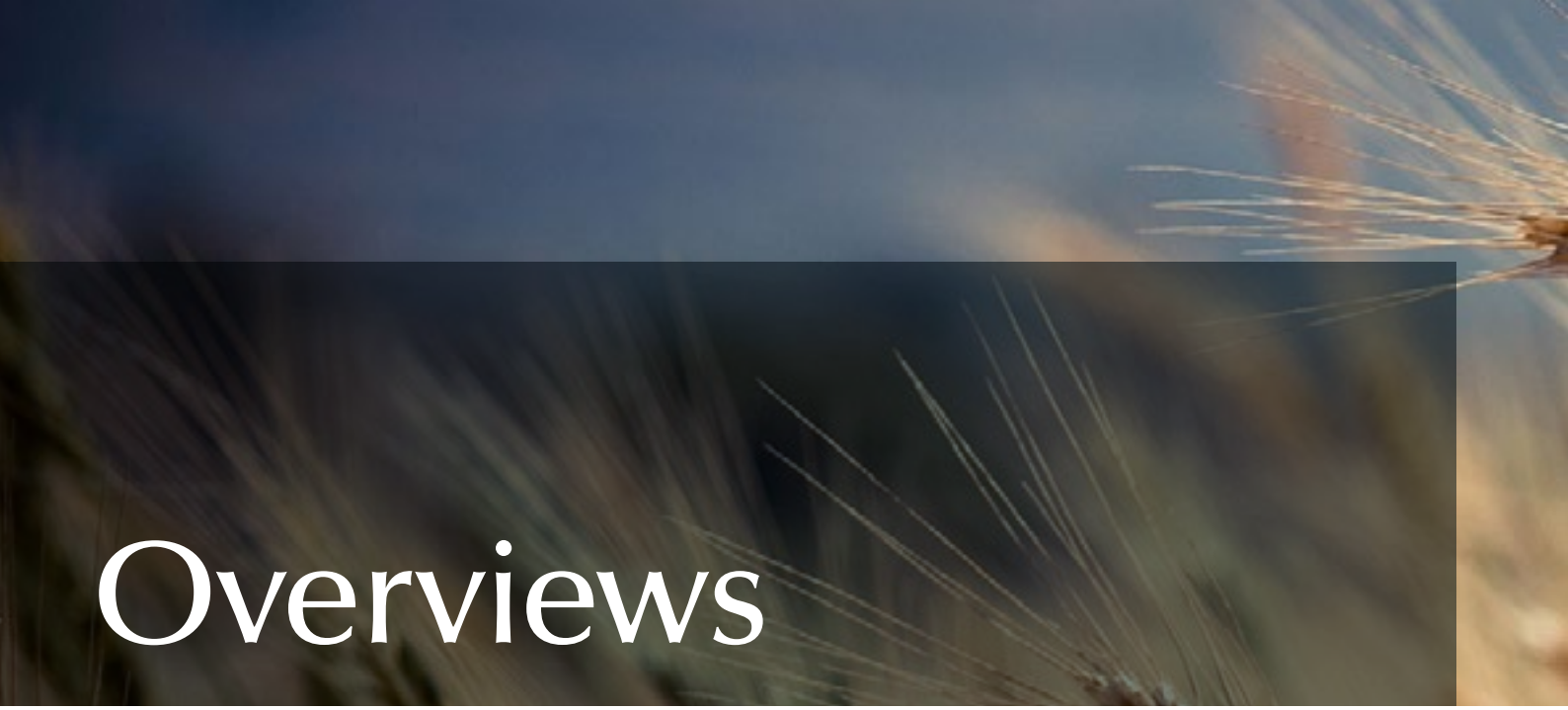
Growth through innovation

The Environment Institute works to commercialise research and give Australian businesses an edge. Research and commercialisation partners are working with governments worldwide to develop DNA tools to support new legislation.

Promoting South Australia's international connections and engagement

The Environment Institute is at the forefront of international connections, both in research partnerships and in research student training. Our staff partner into dozens of countries internationally and they are regular international visitors, as well as hosts to some of the great international scientists of our time.

Our members travelled to the Marrakech Climate Conference as observer delegates, as part of the United Nations Framework Convention on Climate Change.



Overviews

Acting Deputy Vice-Chancellor (Research)

In yet another successful year, members of the Environment Institute have delivered outstanding outcomes of critical societal benefit around climate change, conservation technology and biodiversity. Importantly, the vibrant membership is continuing to expand, and now encompasses all of the University's faculties, promoting a multi-disciplinary approach to tackling important research challenges.

It was pleasing to see, yet again, research funding success by Institute members. Of particular note is the South Australian Oyster Restoration project, one of the biggest restoration projects outside the USA, a substantially funded project aiming to reintroduce the extensive oyster reefs in our gulfs that have been lost since European habitation. This type of applied research exemplifies the important ways in which researchers at the Environment Institute, working with collaborative partners, are delivering economic, social, and environmental benefits to the community. As you read through this report, you will note many such stories of positive impact.

To encourage both high-quality research and innovation, one of the important roles for an institute is to help provide a dynamic and vibrant culture for younger researchers. In 2016, the Environment Institute placed a high priority on its professional development program for early and mid-career researchers; a scheme which is already proving to be very effective in building their success. The Environment Institute continues to contribute strongly to the delivery of the University's mission on research and innovation and in building the workforce of the future.

Finally, on behalf of the University, I would like to express my appreciation to Dr Steve Morton for his considerable service as Chair of the Environment Institute Board over almost 6 years. The University is very appreciative of the time and effort that Steve has devoted to the successful development and ongoing growth of the Institute.

Professor Julie Owens
Acting Deputy Vice-Chancellor (Research)

Advisory Board Chair

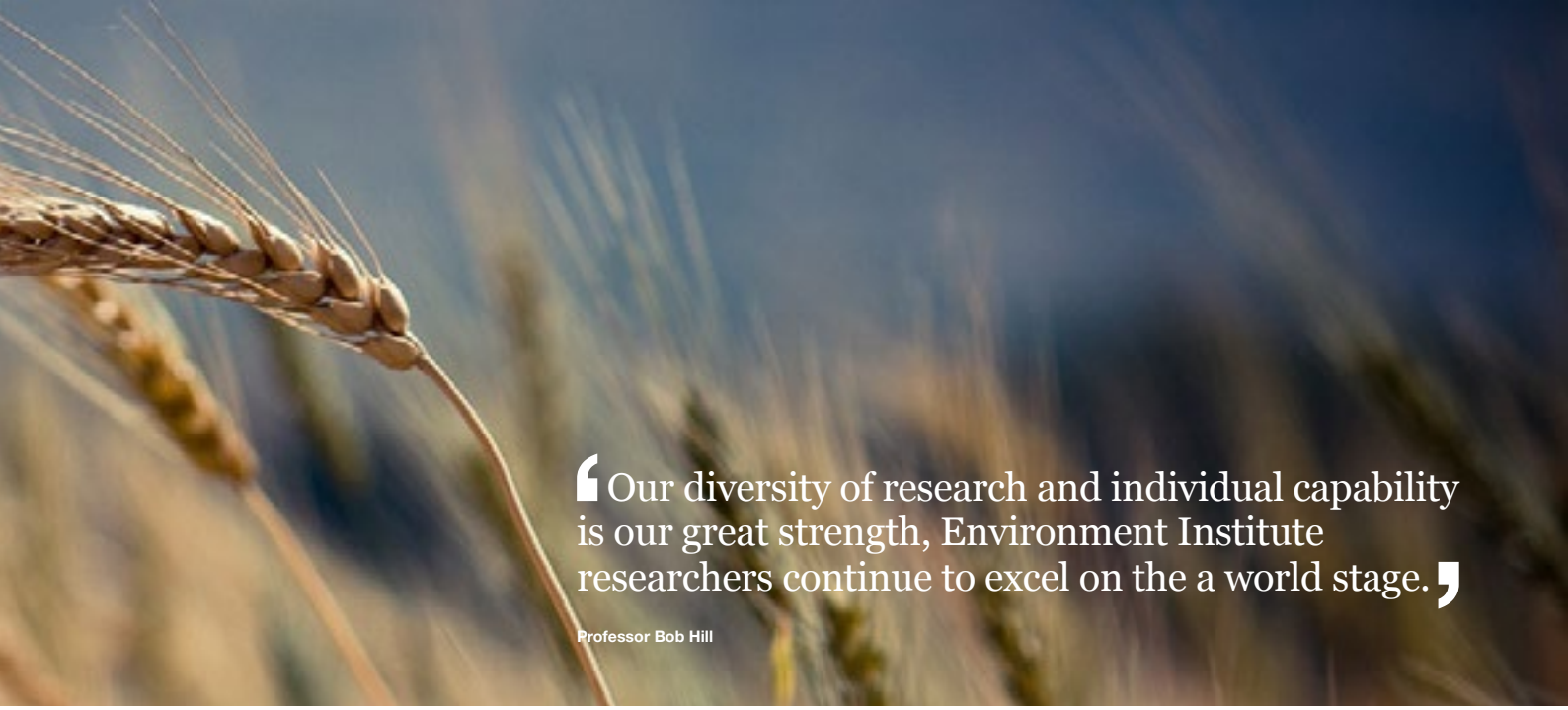
The goal of the Environment Institute – to deliver outstanding research across a broad environmental range by bringing together leading researchers in a variety of relevant fields, including water, biodiversity, marine biology, landscapes and genetics – is of considerable importance to our society and economy. The South Australian community will continue to look to the University for research that helps provide solutions to the challenges thrown up by environmental change, and options for taking advantage of opportunities. The University has made the right strategic decision in building the Environment Institute.

University researchers are looked to by society for guidance and solutions among the big issues of environmental management, and it is essential morally to respond to that need. The institute model is an appropriate mechanism to meet this requirement by providing encouragement to those researchers who wish to deliver benefit directly to the community while they continue with their contributions to scientific achievement.

The Advisory Board judges that the Environment Institute is succeeding in growing such capacities among a proportion of its staff; an example of such success can be seen in the Spencer Gulf project, and several others are in the process of emerging. A cadre of personnel experienced at creating impact in the wider world has been created through mentoring and support, and will continue expanding to the benefit of society as well as to the University. It is hard to imagine development at this pace in the absence of leadership through the Environment Institute.

This report constitutes my final message as Chair. I have stepped aside from this role in the belief that, as with all human endeavour, it is necessary every few years to provide opportunity for fresh eyes and ideas to be brought to bear. It has been my pleasure to serve on the Environment Institute Board, and to witness the excellence of research and collaboration exhibited by its members. The Environment Institute has my continuing support, commitment and good wishes.

Dr Steve Morton
Chair, Environment Institute Advisory Board



Director

The past 12 months have seen a period of considerable consolidation of some major projects within the Environment Institute. Some of the major investments that were made in previous years have began to show tangible benefits. Our diversity of research and individual capability is our great strength, Environment Institute researchers continue to excel on the a world stage.

For instance, the Centre of Ancient DNA was named in the top ten laboratories in the world in Ancient DNA Research by Science.

The Environment Institute continues to foster cross-disciplinary collaboration, and its membership continues to broaden, with significant input now from all five Faculties within the University. Perhaps most encouraging of all was that we managed to attract world class researchers from other parts of Australia and the world to join the Environment Institute and add considerably to our diversity. Two very good examples are Giles Hamm, who was lead author on an outstanding Nature paper on a rock shelter inhabited for 50,000 years in the northern Flinders Ranges, and Kristofer Helgen, who will return to the University of Adelaide in early 2017 after a long and very successful period overseas following his PhD research here.

I am especially proud of the process we have in place to mentor early and mid-career researchers and we are beginning to see tangible outcomes from this high quality program. It is important that we ensure that our less experienced staff are given every opportunity to succeed in what is becoming an ever more competitive environment.

In 2016, our ARC funding success comprised four Linkage grants, three Discovery Awards, one Future Fellowship and two Researchers listed in a new ARC Centre for Excellence. Early and mid-researchers who are achieving research excellence and are leaders in their fields dominated these successes.

It is exciting to assist these talented people build successful careers and deliver on the University’s research strategy. I look forward to seeing continuing world class outcomes from the Environment Institute membership and I expect we will see a major expansion of our success into the future.

I would like to conclude by acknowledging the exceptional input by our retiring Chair of the Advisory Board, Dr Steve Morton. Steve is known throughout Australia and the world as one of the great figures in environmental science. His experience has been of exceptional value to the Environment Institute and I personally value Steve’s input as a mentor, colleague and friend.

Professor Bob Hill
Director

Reconstructing Australian history: the Aboriginal heritage project

Little is known about the genetic history of Aboriginal Australia, despite the ability for this information to help reconnect Indigenous communities disrupted by negative effects of European colonization.

This year, ground-breaking research led by Ray Tobler at the Australian Centre of Ancient DNA, a centre of the Environment Institute, has been published that uses historic hair samples collected from Aboriginal people collected between 1928-1970s to reconstruct the genetic history of Indigenous Australia. The study showed that modern Aboriginal Australians and Torres Straight Islanders are descended from a migrant group that reached Australia around 50,000 years ago. This new data confirms that Indigenous Australians are one of the oldest cultural complexes in the world.

This work was enabled by the collaboration between researchers at the Australian Centre of Ancient DNA, the South Australian Museum (SAM), and Aboriginal Australian families, entitled the Aboriginal Heritage Project (AHP). A central pillar of the AHP is the community outreach model, which was developed in consultation with ethicists and Aboriginal elders. The model is founded upon a family-centric consent process, whereby meetings are held in the communities of hair donors and their families, and where informed consent is sought following detailed explanation of the aims and potential pitfalls of the project. The response to the project has been uniformly positive so far, with more than 99% of all consulted families agreeing to be involved.

The strong support we have received remains a hugely rewarding aspect of the project and highlights the importance of using principled community engagement policies in human genetic research.

The paper published in Nature this year revealed that Australia was originally colonized by a single group, at a time when it was still joined to New Guinea in a single landmass known as Sahul. The subsequent peopling of the continent was rapid, with dual migrations sweeping around the east and west coasts that met somewhere in South Australia, which likely took no longer than 2,000 to 3,000 years. After that, however, the striking genetic differences that we now observe across Australia suggest that populations quickly settled down into specific territories, and have moved very little since then, indicating that these connections have endured for more than 40,000 years.

These findings provide compelling scientific evidence for the significant cultural attachment that Indigenous Australians have for their ancestral homelands, or ‘Country’, and highlights the power and promise of DNA to reveal Aboriginal history and assist in ongoing reconciliation efforts.

The AHP was able to retrieve this striking historical information by using a unique SAM-curated collection of historic Indigenous hair samples that are supplemented by extensive cultural and genealogical data. Crucially, the genealogical data makes it possible to trace the ancestry of the hair sample donors back to a time when Indigenous communities still occupied their ancestral homelands.

Thus, by linking the information stored in the DNA to the pre-colonial geographical distribution of Indigenous people across Australia, we can reconstruct Aboriginal Australian population history as it was prior to European colonization.

There is much work still to do; to date we have only investigated the maternally inherited DNA from 111 individuals, however there are over 6000 hair samples in the SAM collection that could potentially be part of this study. Future research will continue to expand our coverage of Indigenous communities across Australia, and will increasingly focus on information from the whole genome (including the Y chromosome to learn about the history of Indigenous Australian males). This data will be coupled with the massive variation in Australian climate and ecology across both time and space, to learn more about the role that selection has played in generating the extensive biological and physical differences observed in modern Indigenous Australians.

Nature paper launch for the Aboriginal Heritage Project at the SA Museum.

The Adelaide team: L-R Shane Agius, Professor Alan Cooper, Uncle Lewis O'Brien, Dr Ray Tobler, Ali Abdullah-Highfold, Fran Zilio

Image credit: Brad Griffin

> "Aboriginal people have always known that we have been on our land since the start of our time. But it is important to have science show that to the rest of the world. This is an exciting project and we hope it will help assist those of our people from the Stolen Generation and others to reunite with their families."

Kaurna Elder Mr Lewis O'Brien

DNA profiling foils timber theft

Timber theft is the fourth largest criminal trade after arms, human trafficking and drugs. The illegal trade is said to be worth between US$30-100 billion per year.

Some trees such as the Big-Leaf Maple can have end products worth up to $100,000, as the maple is a high value wood used to make high end products such as musical instruments.

A team led by Professor Andrew Lowe and Dr Eleanor Dormontt from the Environment Institute worked with the US Forest Service and timber-tracking specialists Double Helix Tracking Technologies to develop the first DNA profiling reference database for the Big-Leaf Maple.

Their historic involvement in the US Federal Court case is the first time the US Government has prosecuted illegal trade of wood products since the Lacey Act was amended in 2008. The team hopes DNA profiling and tracking of timber provides a means to help curb this illegal activity and support legitimate forest industries.

The evidence they provided to the prosecution was DNA profiling on the timber, like a timber DNA fingerprint. Just like individual humans, each tree has a unique genetic fingerprint, making it possible to match pieces of sawn wood with the stumps of the trees from which they were cut.

The technology assesses whether or not a wood product is derived from a sustainable plantation or, illegally, from a protected area. Using this technology, there is the potential to trace and match timber samples to the area the wood came from.

This could be done from sources as diverse as furniture to timber decking and more, by extracting a DNA fingerprint from a timber product.

“Our database indicates that, with these markers, the likelihood of two trees having the same DNA profile is as low as one in 428 sextillion; there are thought to be approximately 70 sextillion stars in the universe,” Dr Dormontt says.

The identification of genetic markers of a specific timber sample need to matched to a database, however every species has different genetic markers and hence a unique database.

“If we think about the scale of genetic identification with humans, we have one species, but with timber there are currently around 100,000 discovered species of trees in the world.” Says Dr Dormontt.

“And each time you want to be able to identify it, using any technique, whether it be genetics or anatomy or anything, you need to have reference material. So each time for each different species you need to go through that work.”

On the other end of their ground breaking work, the team is motivated to increase consumer knowledge on the prolific illegal trade and allow consumers to make consciencous decisions about the origins of wood products.

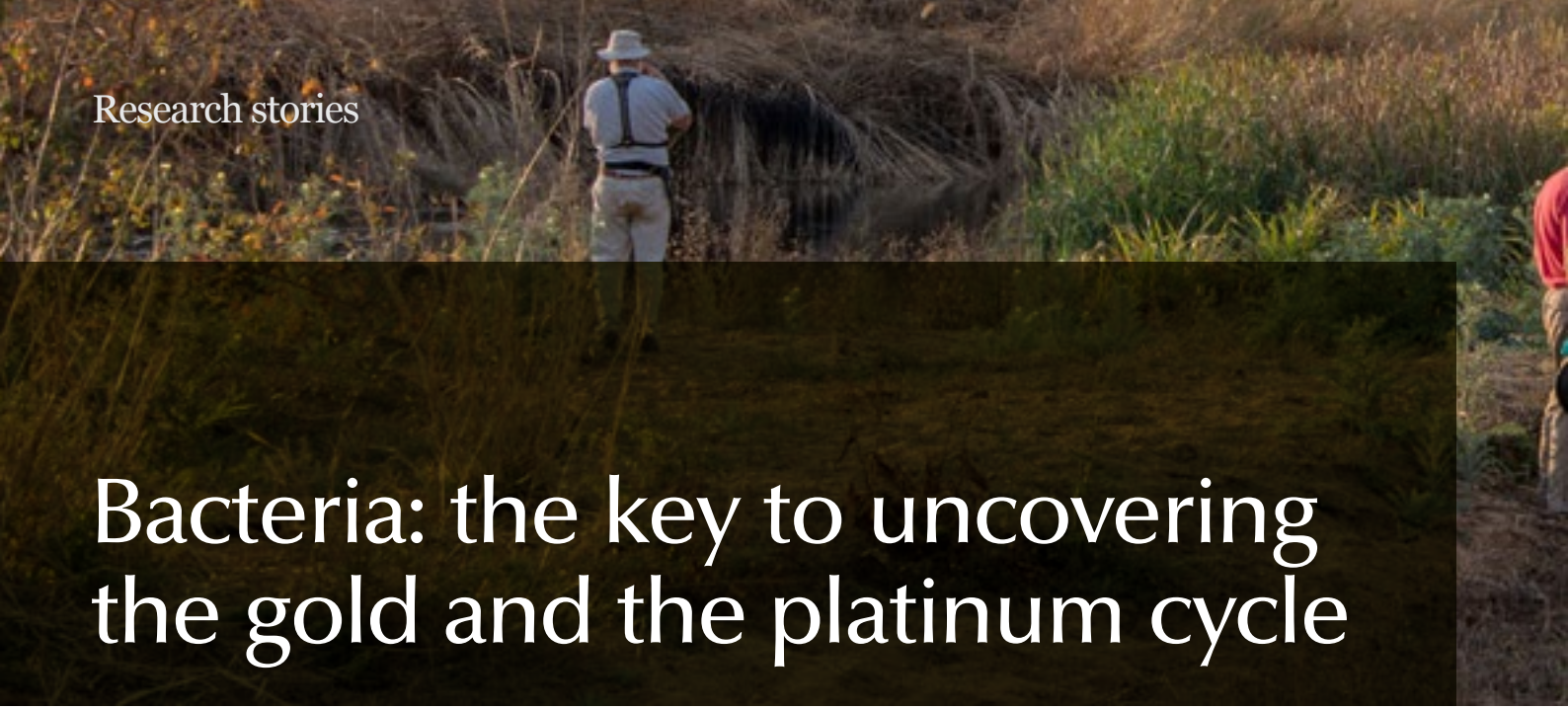
Dr Dormontt has made significant contributions to publication of the United Nations Office on Drugs and Crime (UNODC) Best Practice Guide for Forensic Timber Identification.

The Guide was developed in response to international concerns about the loss of global biodiversity and degradation of natural ecosystems. In particular, the illegal trafficking of wildlife and timber has been recognised as a significant threat to global conservation efforts.

Visit from Her Excellency Ms. Unni Kløvstad, the Ambassador of Norway at the University of Adelaide with Associate Professor Lian Pin Koh, Dr Eleanor Dormontt and Molly Hennekam.

> If we think about the scale of genetic identification with humans, we have one species, but with timber there are currently around 100,000 discovered species of trees in the world.

Dr Eleanor Dormontt



Bacteria: the key to uncovering the gold and the platinum cycle

"Traditionally it was thought that gold and platinum nuggets form only in high pressure and temperature systems deep underground, and that when these metals are brought to the surface through weathering and uplift, they just sit there and nothing further happens to them," says Dr Frank Reith, ARC Future Fellow and member of the Environment Institute.

This static view of the gold cycle is no longer held thanks to the work by Dr Reith and his Microbes and Heavy Metal Group. The group has studied the biogeochemical cycle of gold and platinum for over fifteen years, with a focus on the dynamic of the chemical and biological processes involved in dissolving and moving gold and platinum.

In three new studies, including one published in *Nature Geoscience*, Frank and his team assessed the bio(geo)chemical processes mediated by distinct biofilm consortia living on the gold and platinum nuggets. Molecular community data from hundreds of gold grains collected at more than 15 sites in Australia, New Zealand and South America was assessed.

It was found that a range of organisms contribute predominantly to biofilm establishment and nutrient cycling. While some affect the mobilization of gold, a range of resident Proteobacteria, especially *Cupriavidus metallidurans*, have developed gold-specific biochemical responses to deal with gold-toxicity and reductively precipitate mobile gold-complexes. A chaperone protein was also identified and shown to bind gold.

This now forms the basis of research co-funded by the Environment Institute to develop a protein-based biosensor for in-field gold detection.

To assess if similar mechanisms also apply to the (trans)formation of platinum grains, Dr Reith travelled to remote areas of Brazil and Australia to recover these rare samples. Electron microscopy showed that biofilms did indeed cover these grains. The biofilms were dominated by bacteria, which were closely related to known metal-resistant species.

Dr Reith, who started his Future Fellowship project *'Geobiological gold cycling: Golden opportunities for the minerals industry'* in 2016, aims to develop new geobiological tools for gold exploration and processing that are rooted in the fundamental understanding of geobiological gold cycling. A particular aim is to assess gold cycling worldwide, and so in 2016 Dr Reith mounted expeditions to remote locations in the heart of Australia, South Africa and Finland in search of the elusive noble metals, and their life cycles.

Further reading

Zammit CM, Weiland F, Brugger J, Wade B, Nies DH, Southam G, Hoffmann P, Reith F (2016) Proteomic responses to gold(III)-toxicity in the bacterium *Cupriavidus metallidurans* CH34. *Metallomics* 8, 1204-1216.

Reith F, Zammit CM, Shar SS, Etschmann B, Bottrill R, Southam G, Ta C, Kilburn M, Oberthür T., Ball AS, Brugger J (2016) Biological role in the transformation of platinum-group-mineral grains. *Nature Geoscience* 9, 294-298.

Rea MA, Zammit CM, Reith F (2016) Bacterial biofilms on gold grains—implications for geomicrobial transformations of gold. *FEMS Microbiology Ecology* 92 (6), fiw082.

Gold panning At the Prophet Gold Mine, Kilkivan, QLD

Above top: Gold panning At the Prophet Gold Mine, Kilkivan, QLD.

Above bottom: Site at the Mt. Morgan mine, QLD, showing secondary minerals precipitating from the acidic mine tailing solutions.

Rotary sluice used for placer gold mining in Barberton, South Africa.

Image credit: Brad Griffin

Iconic cuttles and cephalopod overlords

Not only does the Spencer Gulf support a unique species of the iconic Australian cuttlefish, but this Marine Park represents the only known breeding aggregation of cuttlefish in the world.

Professor Bronwyn Gillanders says, "The [cuttlefish] really are quite spectacular organisms coming together to breed along a small stretch of rocky coastline in northern Spencer Gulf, South Australia, during the winter months".

Prof Gillanders has studied the Spencer Gulf cuttlefish for over fifteen years, involving researchers from the South Australian Museum, SARDI Aquatic Sciences and PIRSA Fisheries. This collaboration investigated the geographic boundaries of the breeding aggregation population and developed a model to assess how it responded to environmental and man-made impacts.

Through this work, Prof Gillanders discovered the abundance of the species declined dramatically from 2011 to 2013, and concerns were raised about the sustainability of cuttlefish in Spencer Gulf and lack of information of the species. Investigations in to why the cuttlefish numbers were dropping was proposed, but there was not enough long term data on giant Australian cuttlefish abundance to answer this question.

To answer this question, Prof Gillanders and Drs Zoe Doubleday and Thomas Prowse from the Environment Institute at the University of Adelaide led a global project in to the abundance of cephalopods.

They predicted if other cephalopods showed oscillating patterns in abundance then perhaps this may suggest that this decline of the giant Australian cuttlefish was also part of a natural cycle.

They assembled a global-scale dataset of cephalopod abundance and coordinated a group of international researchers for a workshop investigating trends in the data. To their surprise, rather than a cyclical pattern in abundance, the international team found that cephalopod populations have increased over the last six decades. This trend was staggeringly consistent across diverse groups of cephalopods. These results suggest that the global increase in cephalopods has been driven by large scale processes, common to a range of coastal and oceanic environments and characteristics common to all cephalopods.

The increase in cephalopods has implications for marine food webs and us! Squid, cuttlefish and octopus are voracious and adaptable predators, and an important source of food for marine species. They also support important commercial and subsistence fisheries around the world.

This research captured the world's attention, featuring in over 100 news outlets including high profile mainstream news such as *The New York Times* and major scientific news outlets such as *Science Magazine*, *Nature and Scientific American*. The story was even mentioned by satirical American news outlet, *The Onion*.

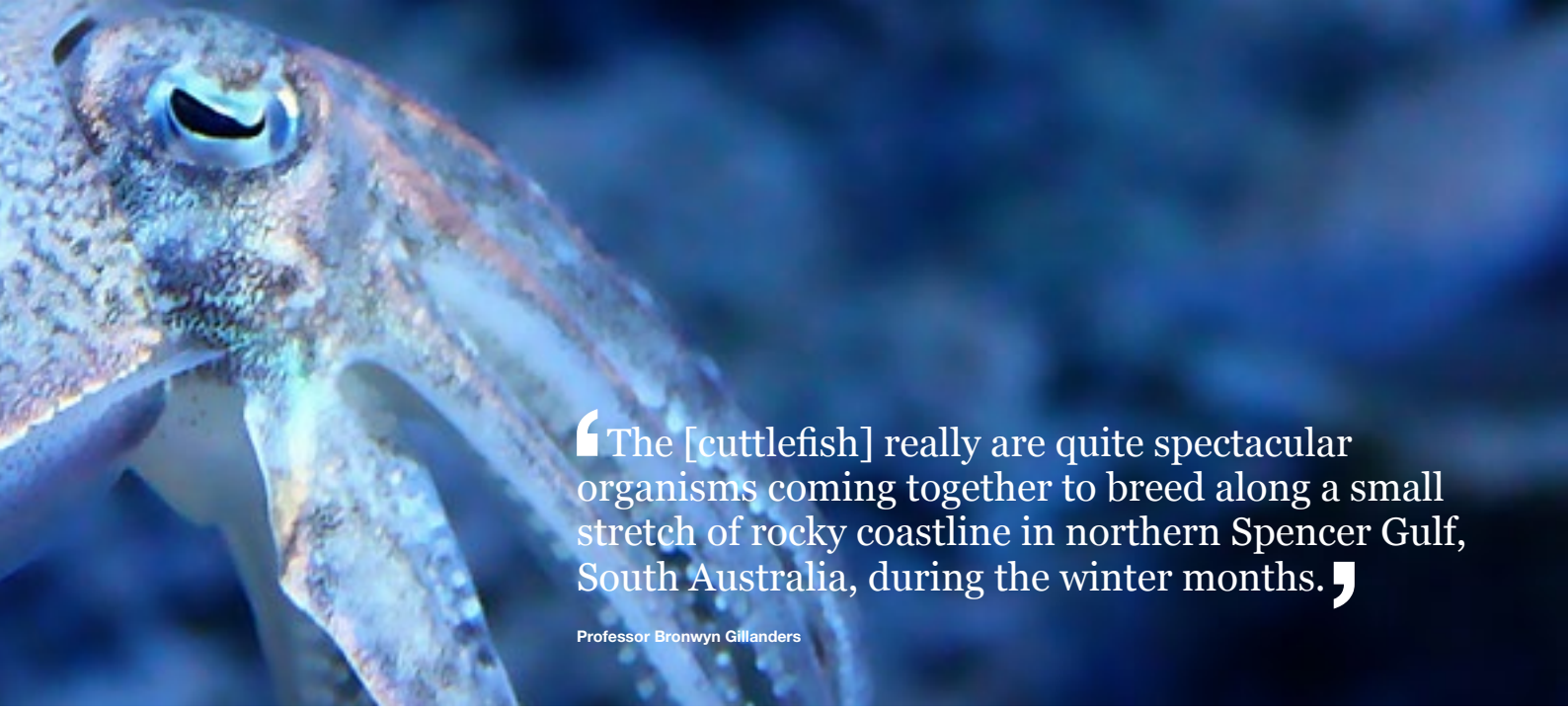
Prompted by the media interest in their good news story, the team made a video to document and explain their work to submit to the National Peer Prize for Women in Science. Prof Gillanders and Dr Doubleday continued their winning streak by taking out the top prize in the Environmental and Life Sciences category.

Watch their video.

Further reading

Doubleday ZA, TAA Prowse, A Arkhipkin, GJ Pierce, J Semmens, M Steer, SC Leporati, S Lourenço, A Quetglas, W Sauer, BM Gillanders. 2016. Global proliferation of cephalopods. *Current Biology* 26: R387-R407.

Gillanders BM, SC Donnellan, TAAC Prowse, D Fordham, C Izzo, S Myers, K Rowling, M Steer, SH Woodcock. 2016. Giant Australian cuttlefish in South Australian waters. Final report to the Fisheries Research and Development Corporation. University of Adelaide, Adelaide. 91 pages.



> The [cuttlefish] really are quite spectacular organisms coming together to breed along a small stretch of rocky coastline in northern Spencer Gulf, South Australia, during the winter months.

Professor Bronwyn Gillanders

Cephalod numbers are on the rise in the Spencer Gulf.
Above: A luminescent squid.

A giant cuttlefish.

Colours of South Australia: native advantage for local food industry

In recent years, public concern and consumer pressure about the safety of preservatives, pesticides and synthetic pigments in foods has grown, and demanded alternative avenues be explored.

To meet this need, the Australian Bioactive Compounds Centre (ABCC) at the Environment Institute is identifying naturally occurring food dyes from native Australian edible plants.

The ABCC was established in 2016 as joint facility between the University of Adelaide and the University of South Australia. The centre endeavours to apply its collective expertise to use ecological and Indigenous knowledge to improve the efficiency of identifying biologically active compounds from plants found in Australia, in particular from its unique arid environments. It hopes to fast-track these compounds into commercially useful products in areas including medicine and agriculture.

With this collective knowledge and outward vision, the ABCC was recognised with an Innovations Connections grant under the Australian Government's Entrepreneurs' Program. With this acknowledgement from the Department of Innovation, Industry and Science, the ABCC was perfectly positioned to meet the existing industry need.

Spring Gully Foods, a South Australian Family company with the motto "There's no taste like home", had a particular interest in identifying local, natural food colours that they could use in their products – but had no clear mechanism for identifying such compounds and assessing their suitability for use.

Together, the ABCC and Spring Gully Foods, embarked on a $50,000 project to evaluate a native South Australian saltbush species for its suitability as a source of natural food colourants.

Dr Casey Hall, a postdoctoral research fellow at the ABCC, led the identification of betalains from the Mallee saltbush (Rhagodia preissii). This bioactive compound is highly coloured and is known to have anti-oxidant and anti-cancer effects. Betalins can also produce a strong colour using only a very small amount of the compound, a characteristic called high tinctorial strength. The compound, importantly, was also shown to be non-toxic to human cells.

When tested on Spring Sping Gully's legendary pickled onions, they turned red – the betalin coloured them right through to the centre! This work demonstrates a newly identified source for this antioxidant natural source of food colouring, and it is possible that the betalains represent new compounds, so further work is ongoing to identify these.

The established health-promoting bioactivity of betalains could make them ideal additives to manufactured food products, if a reliable supply can be established for industry. Due to its natural ability to thrive in semi-arid conditions, the Mallee saltbush could be an ideal plant for cultivation in drier, rural areas of South Australia.

The results provide a basis for the development of novel Australian food products with important bioactive compounds, high marketability, and the potential to provide a much needed boost to regional economies.

Dr Cassey Hall in the field in South Australia, collecting the Mallee Saltbush samples.

The pigmentation from the Mallee saltbush makes them a great candidate for colouring the pickled onions.

Global collaborations helping to save emu-wrens from extinction

Wetspots around the world are predicted to become important refuges for native diversity in our rapidly changing climate. Yet new research warns our precious wetland biodiversity (including our iconic southern emu-wrens) are threatened by a European strain of our native common reed.

Common reed (*Phragmites australis*) is one of the most cosmopolitan species as it grows anywhere that it can access fresh water. This diverse habit can range from desert oases to the Nepalese mountains, and the reed is recognised as an ecological engineer because it triggers succession from open water to woodland.

The Environment Institute's Dr Jasmin Packer last year published a review of the impacts of the common reed on native flora and fauna in one of the world's most authoritative sources for botanical knowledge. Her work with international collaborators from the Czech Republic, Switzerland and U.S.A. identifies Australia as one of the hotspots where the native and non-native ranges of reeds overlap.

The publication was the culmination of two years of research that was triggered by a request from Conservation SA for Assoc Professor Jose Facelli and Dr Packer to investigate whether the expansion of common reed was threatening the endangered Mount Lofty Ranges southern emu-wren (Stipiturus malachurus intermedius), in the critically endangered Fleurieu Peninsula Swamps. This conservation collaboration is continuing with the Government of South Australia and remarkable research students like Tessa Roberts and Diego Guevara.

Dr Packer's research aims to understand which of our Australian reed beds are native, which are not, and which could be managed for better environmental and economic outcomes. The European strain of common reed is a serious threat for our biodiversity. Their vision is to work with our global and local partners to save our species such as the Mt Lofty Ranges emu-wren from extinction, improve water security and capture bioresources to support our rural communities.

To accomplish this, Dr Packer attended a global workshop in Italy last year with global experts on the botany, biogeography, ecology, genetics and management of common reed. The workshop outcomes, published in Biological Invasions, recommended global, transdisciplinary networks to develop new science that addresses the big picture questions of how to best protect both Australian native and global ecosystems from the increasing spread of invasive strains and species. Stage 1 of these experiments are being conducted at the University of Adelaide, in collaboration with our research partners in Argentina, Czech Republic, Italy, Switzerland and USA.

"The potential for circular resource opportunities is exciting! Imagine harvesting reeds to protect natural treasures like emu-wrens – and then using the reeds to fuel our rural communities" Dr Jasmin Packer.

Further reading

Packer, J.G., Meyerson, L.A, Haslam, S.M., Skálová, H., Pyšek, P. and Kueffer, C., Biological Flora of the British Isles: Phragmites australis, Journal of Ecology (online early), doi: 10.1111/1365-2745.12797

Packer, J.G., Meyerson, L.A., Richardson, D.M. et al., 2016. Global networks for invasion science: benefits, challenges and guidelines, Biological Invasions, 19, 1081-1096, doi: 10.1007/s10530-016-1302-3

Diego Guevara in the field in at Mt Lofy looking for the endangered emuwren.
Below left: the endangered emuwren among the Common Reed
Picture credit: Diego Guevara

> The potential for circular resource opportunities is exciting! Imagine harvesting reeds to protect natural treasures like emu-wrens – and then using the reeds to fuel our rural communities.

Dr Jasmin Packer

Evolutionary novelty in snake vision

Vertebrate retinas are typically populated by two kinds of photoreceptors with distinct morphologies and functions: cones are responsible for colour vision and rods are sensitive under low light conditions. However, some species of snakes and geckos provide rare exceptions to this two part arrangement.

Geckos that have pure-cone retinas lost their rods as an adaptation to a bright-light, day active lifestyle, while some nocturnal geckos subsequently evolved pure-rod retinas. The reverse is seen in garter snakes and some sea snakes that inherited all-rod retinas from a nocturnal ancestor but subsequently adapted to a day active lifestyle and possess all-cone retinas. Other species of snakes and geckos have intermediate photoreceptor cells that resemble both rods and cones.

This unexpected diversity led vision biologist Gordon Walls to develop his photoreceptor 'transmutation' theory in 1934. Walls suggested that rods and cones are not fully independent, but could morph into one another via a series of intermediates during evolutionary transitions between day active and nocturnal lifestyles. In other words, rods could re-evolve from cones in secondarily nocturnal lineages that had lost cones, and vice versa. Unfortunately, in 1934 Walls lacked the methods to test his theory by identifying the visual pigments (opsins) that are characteristic of the different photoreceptor types. Cone photoreceptors express only cone pigments and rods express only rod pigments, so cones that have evolved via transmutation of rods should express rod pigments, and rods that have evolved from cones should express cone pigments.

Dr Bruno Simões, Dr Kate Sanders and their international colleagues revisited Wall's theory by sequencing the visual pigment genes expressed in the retinas of a diverse sample of snakes. They found that the visual pigments expressed in certain snakes were indeed decoupled from the photoreceptor type: rods that were modified to resemble (and presumably function) as cones expressed rod pigments, and cones that resembled rods expressed cone pigments. Their study showed that Walls' theory was essentially right, and also revealed that both cone-to-rod and rod-to-cone transmutation has occured at least twice during snake evolution.

It is intruiging that reptile photoreceptors are so evolutionarily liable to change - all other vertebrates, including fishes, birds and mammals, appear to have retained the duplex retina of rods and cones for hundreds of millions of years. But what genetic mechanisms allow photoreceptor transmutation in reptiles? And what is the functional significance of the physical differences between typical rods and cones? These questions are a key focus of new research combining comparative genomics and transcriptomics with eye physiology and anatomy for Australia's diverse reptile fauna.

Dr Bruno Simões currently holds a Marie Skłodowska-Curie Global Fellowship from the European Union that is jointly hosted by Dr Kate Sanders, a member of the Environment Institute at the University of Adelaide, and the University of Bristol, UK.

Further reading

Simões BF, Sampaio FL, Loew ER, Sanders KL, Fisher RN, Hart NS, Hunt DM, Partridge JC, Gower DJ. 2016. Multiple rod-cone and cone-rod photoreceptor transmutations in snakes: evidence from visual opsin gene expression. Proceedings of the Royal Society B. 283: 1823.

Simões BF, Sampaio FL, Douglas RH, Casewell NR, Harrison RA, Hart NS, Partridge JC, Hunt DM, Gower DJ. 2016. Visual pigments, ocular filters and the evolution of snake vision. Molecular Biology & Evolution. 33: 2483–2495

New discoveries have been made into the evolution of reptile photo sensors.

Investing in our future leaders

In 2016, the Environment Institute hosted a Leadership Development program for post-doctoral fellows who are a part of the Institute. The intention of the course was to find, encourage and support a high calibre pool of potential future leaders for the Environment Institute. The course was run by Paul Dalby from In Fusion Consulting and Karilyn Fazio from The Impetus Team.

The course sought to increase the participants' understanding of what they want to achieve from their career. They were provided tools to more effectively build their profile and influence, attract new funding, build more successful teams and better manage their time and energy. They were challenged to develop self-awareness of their strengths and development areas, and to create strategies to be more resourceful and resilient. They were required to become familiar with blogging and social media tools and to trial time and energy management strategies.

The group met with successful leaders in academia and potential funding organisations and were advised on pathways to build their success in attracting grants and building their own lab group. Finally, each participant had to present a $1M+ research idea to a 'Dragon's Den' of potential investors. Some of the participants have continued with coaching from either Paul or Karilyn.

As a result of the program, participants said that they were more confident in being able to effectively manage their research teams, independently findtheir own research funding, and build their own personal profile.

One of the participants, who presented an idea to improve conservation outcomes at the Dragon's Den, has since pitched the same idea to various government agencies and is now in negotiation with one of these agencies for funds for a landmark project that has the potential to change the way we protect threatened species in Australia. She continues to be supported in her efforts by the Environment Institute.

Another participant approached a state government agency and negotiated to sit in their offices one day a week to interact with their staff. He is using this as a way of building his brand and influence in this agency and to find common projects to work on together.

Another idea that emerged from the Dragon's Den was to investigate the potential role that native foods have on human health. The researcher who presented this idea is in discussion with a local Aboriginal group to explore the idea further.

A bold idea to develop a new aquaculture industry in South Australia, based on one of our native species, was initiated by one of the participants in the course. He has since moved on from the University of Adelaide, but the Environment Institute is continuing discussions with State Government about developing his idea further.

Those who participated in this course are to be congratulated for taking steps to improve their leadership skills and capabilities, and the Environment Institute will continue to be supportive of them as they progress in their careers within the University.

Researcher engagement

Participation in DEWNR, Natural Resource Management Conference

The 2016 South Australian Natural Resource Management Science Conference showcased the science behind environmental decision making, policy and management in South Australia.

The conference was attended by 1000 delegates from across the government, research and industry sectors as well as members of environmental groups and the community.

There were 285 presentations covering a range environmental topics including climate change, water management, conservation and management of biodiversity and fire ecology.

Plenary speakers were sourced from around the world and included two international speakers and key national speakers.

The Conference was designed to serve as a platform for connection between researchers and policy makers in South Australia and those in the wider natural resource management community, so every effort was made to ensure the widest reach.

Every presentation was live-streamed so that regional, remote, interstate and international colleagues could follow along and interact with the conference in real time. A hashtag was used on Twitter to encourage interaction and engagement. Videos of all presentations were made available online after the event.

Participation in DEWNR, Natural Resource Management Conference

Conference presentations received media attention on SBS, New Scientist and Adelaide Now.

Date	Speaker	Description
13 April	Dr Zoe Doubleday,	Threats to Spencer Gulf
	Assoc Prof John Tibby	Are we underestimating the risk of climate change in South Australia
	Dr Thomas Barnes,	The movement of mulloway around the Great Australian Bight
	Stefan Caddy-Retalic,	An Isotopic TREND: Water stress in South Australian flora
	Assoc Prof Ivan Nagelkerken	Ocean Acidification
	Assoc Prof Frank Grutzner	Investigating the basis of echidna biology for application in conservation, wildlife management and habitat monitoring
	Assoc Prof Bertram Ostendorf	Management and conservation issues of the southern hairy-nosed wombat
	Dr Pablo García-Díaz	The devil within: The biosecurity risk of illegal pet reptiles in Australia
	Dr Thomas Prowse	Prescribed burning urbanises bird assemblages in the Mount Lofty ranges

Date	Speaker	Description
13 April	Dr Katja Hogendoorn	Management of biodiversity for apple and pear pollinators
	Michael Swinbourne	Historical changes in the distribution of hairy-nosed wombat
	Robert Cirocco	Sucking the lifeblood out of major invasive weeds of Australia
	Prof Bronwyn Gillanders	Seascape genetics for shark management
	Dr Greg Guerin	Centres of plant biodiversity in South Australia
	Assoc Prof Phill Cassey	The onshore biosecurity threat from the domestic cage-bird trade
	Sanjina Upadhyay	Assessing the influence of operation of an environmental flow regulator on ecosystem productivity
14 April	Prof Phill Weinstein, ABCC	Keynote: Does biodiversity supress infectious disease?
	Prof Bob Hill	The vegetation history of South Australia
	Assoc Prof Cesca McInterny	Molecular and isotopic insights into botanical history in South Australia
	Dr Casey Hall	Ecologically-guided discovery of bioactive plant compounds
	Dr Greg Guerin	Projected climate change implications for the South Australian flora
	Assoc Prof Bertram Ostendorf	Islands as refuges for threatened species: The success of multispecies translocation to Wedge Island
	Dr Katja Hogendoorn	Of bees and burns: conservation of the green carpenter bee Xylocopa aeratus in relation to fire-history on Kangaroo Island
15 April	Prof Michelle Waycott	Keynote: The grander view for “our” science ocean acidification
	Prof Robert Hill, Sandy Carruthers, DEWNR	Keynote: Strange bedfellows: Dating rules for research partnerships
	Prof Andy Lowe	Restoring South Australia’s native vegetation
	Prof Megan Lewis	Dalhousie Springs wetland composition, function and dynamics revealed by remote sensing
	Adjunct Professor Steve Cooper	Implications of uncertain taxonomy for conservation management: Case studies on bandicoots and gliders

Institute engagement

Date	Media release
7 Jan	Plant biodiversity and key threats mapped for South Australia
8 Jan	Banning trophy hunting could do more harm than good
20 Jan	Ancient genomes reveal that the English are one third Anglo-Saxon
22 Jan	Mixing a genetic paint box leads to new butterfly wing patterns
1 Feb	Climate not to blame for megafauna extinction in Australia
4 Feb	Study identifies most vulnerable tropical reef fish
5 Feb	Radar reveals the hidden secrets of wombat warrens
22 Feb	Alien plants and animals drive native species to extinction
7 Mar	Genetic profiling of trees helps convict timber thieves
16 Mar	Silent oceans: acidification stops shrimp chorus
22 Mar	Uncovering bacterial role in platinum formation
22 Mar	Biodiversity brings disease resistance: Novel study
2 Apr	Ancient DNA shows European wipe-out of early Americans
8 Apr	New models predicting where to find fossils
14 Apr	New centres for native plant remedies, conservation
20 Apr	Ancient DNA reveals evolution of giant bears in the Americas
24 May	Call to minimise drone impact on wildlife
24 May	Squids on the rise as oceans change
8 Jun	Sea snakes have extra sense for water living
14 Jun	Population policy to impact emissions targets
18 Jun	Ancient DNA shows perfect storm felled Ice Age giants
28 Jun	Global economic pressures require stronger action locally
29 Jun	Baby fish lose poisonous protectors in acidified oceans

27 Jul	NZ wren DNA analysis reshapes geological theory
3 Aug	New partnership to boost Asia-Pacific conservation
9 Aug	Stowaway frogs being stopped by border security
12 Aug	Professor Alan Cooper is SA Scientist of the Year
18 Aug	90 years of monitoring change in arid zone
5 Sep	Nutrient pollution is changing sounds in the sea
8 Sep	Opening windows to the Universe and Australia's origins
14 Sep	Investigating native plants for South Australian pickles
5 Oct	Invasive insects cost the world billions per year
10 Oct	'Snotty gobble' could be good weed controller
12 Oct	Temporary extinction reprieve for some frogs
19 Oct	The Higgs Bison - mystery species hidden in cave art
1 Nov	$16.5 million awarded for new research discoveries
3 Nov	Humans settled Australia's arid zone 49,000 years ago
8 Nov	Increasing cost of natural hazards as climate changes
14 Nov	Call for global action to stamp out illegal timber trade
17 Nov	Snake black market poses risk to humans and wildlife
30 Nov	Platypus venom could hold key to diabetes treatment
3 Dec	Trapdoor spiders disappearing from Australian landscape
19 Dec	Barramundi populations at risk from acid oceans

Environment Institute activities

Featured Speakers

The Environment Institute was host to the following local and international speakers in 2016:

Date	Speaker	Description
5 Feb	Dr Jon Tyler, University of Adelaide	Reconstructing Paleoclimates (Science in the Pub)
9 Feb	Dr Diego García-Bellido, University of Adelaide	Fossils at Emu Bay, Kangaroo Island (Research Tuesdays)
12 April	A Prof Jeremy Austin, University of Adelaide	CSI Techniques (Research Tuesdays)
27 May	A Prof Greg Jordan, University of Tasmania	Five reasons why we might underestimate climate change (SPRIGG Seminar Series)
1 June	Prof Alan Cooper and Dr Raymond Tobler, University of Adelaide	Using DNA to rediscover genetic heritage of Indigenous Australia (Public Lecture)
26-30 June	Prof Phill Weinstein, University of Adelaide	Earth's evolving climate (SPRIGG Symposium)
15 July	Dr Zuzana Burivalova, Princeton University, USA	Tropical forest degradation
15 July	Dr John La Salle, Director of the Atlas of Living Australia, CSIRO	The Atlas of Living Australia: Supporting biodiversity discovery, documentation and analysis (ACEBB Systematics workshop)
16 Aug	Dr Laura Weyrich, University of Adelaide	Lessons from Neandertals (SPRIGG Seminar Series)
19 Aug	Professor Robert Hill, University of Adelaide	Elemental drivers of the Australian vegetation (Department of Ecology and Environmental Science Seminar Series)
26 Aug	Prof Chris Turney, UNSW	Investigating the mechanisms of abrupt and extreme climate change
7 Oct	Dr Laurie Menviel, UNSW	Role of ocean circulation in climate change (SPRIGG Seminar Series)
21 Oct	A Prof Ian Goodwin, Macquire University	Antarctic ice sheet stability

21 Oct	Associate Professor Ian Goodwin, Macquire University, AUS	What do Australian coasts tell us about past climate and Antarctic Ice Sheet Stability?
27 Oct	Dr Babette Hoogakker, University of Oxford, UK	Ocean oxygenation (SPRIG Seminar Series)
27 Oct	Dr Babette Hoogakker, University of Oxford, UK	New methods to assess ocean oxygenation in the past; examples from the Atlantic and Southern oceans (SPRIGG Seminar Series)
28 Oct	Dr Frédérik Saltré, University of Adelaide	Who killed the world's largest mammels over the last 50,000 years (ACEBB)
4 Nov	Prof Stephen Pruett Jones, University of Chicago, USA	Naturalised parrots in the United States

Conferences and Workshops

The Environment Institute supported the following conferences and workshops in 2016:

Date	Description
13-15 Apr	The DEWNR NRM Science Conference
26-30 Jun	Sprigg Symposium
10-15 July	4th Annual Postgrad ACEBB Systematics workshop
5-9 Sep	INQUA Early Career Researcher and Summer School, United Kingdom
28 Nov – 2 Dec	Climate Change Megafaunal Extinctions Workshop, ACAD
3 Feb	The Inaugural Australia Partner Workshop, Canberra
11-15 July	Paleo Down Under Conference, Adelaide
13-15 Feb 2017	Numerical Analysis of Palaeoenvironmental Data Course

Awards and achievements

Leanna Read, Chief Scientist, presenting Alan Cooper with his award.

Congratulations to Environment Institute members

Award	Recipient	Description
Order of Australia	Dr Ron Sinclair	Dr Sinclair is a Research Fellow of the Invasion and Ecology Group and was awarded the Order of Australia for his decades of research in the management of invasive species. He was also recognised for his advocacy work for Alzheimers disease and support for regional communities.
Science Magazine's Top 10 Labs Worldwide for Ancient DNA	Australian Centre for Ancient DNA	Science magazine has named the top ten labs in the world that specialise in ancient DNA research which included the Australian Centre for Ancient DNA, a centre of the Environment Institute.
South Australia's Scientist of the Year	Prof Alan Cooper	This honour is awarded to an individual who has demonstrated decades of excellence in their field by making an outstanding contribution to science. Alan Cooper is the Director of the Australian Centre for Ancient DNA.
President of World Council Fisheries Societies	Prof Bronwyn Gillanders	The World council is a non-profit, non-governmental organisation for scientific or professional fisheries societies. Prof Gillanders will serve for a four year term.
K Radway Allen Award	Prof Bronwyn Gillanders	The K Radway Allen Award is the highest award granted by the Australian Society for Fish Biology (ASFB) for extraordinary contribution to fish and fisheries sciences. She is the first South Australian and first woman to receive this prestigious award.
Winnovation SA Award	Prof Bronwyn Gillanders	Professor Gillanders has been recognised for her work with the Spencer Gulf Ecosystem & Development Initiative (SGEDI). The Initiative, which is led by the Environment Institute, aims to preserve the environmental brilliance of the Spencer Gulf ecosystem while advancing economic development.
SA Science Excellence Awards Finalist Excellence in research collaboration	Prof Andrew Lowe	Prof Lowe was recognised as a finalist in the SA Excellence Awards for excellence in research collaboration.
SA Science Excellence Awards Finalist	Prof Philip Weinstein	Phil Received this year's award for his significant and discernible contribution in the combined domains of public health, ecology and environmental health. The Public Health association has named the award after Professor Tony McMichael, who was a world leader in research and advocacy for incorporating ecological and environmental factors into the field of public health (including climate change)

Award	Recipient	Description
PhD Research Excellent and Career STEM Professional	Kieran Mitchell	Kieran Mitchell was nominated for his achievement in marsupial evolution, high-throughput sequencing, bioinformatics, phylogenetics/modeling, and the use of cutting-edge research in DNA sequencing.
The Peer Prize for Women Science	Prof Bronwyn Gillanders and Dr Zoe Doubleday	The collaboration of Prof Gillanders and Dr Doubleday were awarded the Peer Prize for Women for their research on rising cephalopod numbers. The competition received 40 entries from across Australia and a total of 1474 votes from verified researchers around the world.
Academic Women's Research Excellence Award	Dr Zoe Doubleday	The University of Adelaide recognised Dr Doubleday for her contribution to her field during a ceremony for International Women's Day.
Contribution to Forensic Geology	Dr Jen Young	Dr Jen Young was recognised as one of the top, young scientists and thanked for her contribution to forensic geology by invitation to join the prestigious International Union of Geological Sciences- Initiative on Forensic Geology (IUGS-IFG).
Australian-American Fulbright Scholarship	Jenna Crowe-Ridell	The recipient of an Australian-American Fulbright Scholarship is sponsored to study at an American college.
Australia-India Strategic Research Fund Fellowship	Vicki Thomson	Four Australia-India Strategic Research Fellowships are awarded which enable Australian researchers to work collaboratively with Indian scientists. The fund is supported by the Australian Government and is dedicated to solidifying bilateral ties with India.
SARDI Women's Science Bursary	Jasmin Martino	The Bursary was established in 1994 to commemorate the SA Women's Suffrage Centenary. Jasmin will use her bursary to help support research in SA's Snapper Industry through her PhD thesis.
FameLab	Erinn Fagan-Jeffries	FameLab is the world's largest science communication competition where National winners go on to compete against twenty four countries in Cheltenham, England.
Best Student Oral Presentation	Dr Tullio Rossi	Tullio Rossi was awarded best student oral presentation at the 4th International Symposium on the Ocean in a High CO2 World for his presentation on ocean acidification.
Best Poster Presentation	Felicia Bardan	Felicia Bardan won best poster for her presentation of historical DNA databases at the Australian and New Zealand Forensic Science Society (ANZFSS) conference in Auckland.
Best Wildlife Talk	Duncan Jardine	Duncan Jardine won best wildlife talk for his presentation on illegally logged timber at ANZFSS
Best Student Poster	Martin Ankor	Martin Ankor won best student poster at Australasian Quaternary Association (AQUA) conference
Best Student Technical Poster	Briony Chamberlayne	Briony Chamberlayne won best technical poster at AQUA. As part of this award, she receives a fully funded training workshop in Wellington in 2017.
Best Student Presentation	Siân Howard	Won best student presentation for their project 19th Australian Organic Geochemistry Conference.
Best Student Presentation	Georgina Falster, Nigel Rees, Alison Kirby, Joseph Rugari and Drew Lubiniecki	These five Environment Institute students took home five out of six prizes for student presentation at the Australian Earth Sciences Convention.

Funding outcomes

Type	Announced	Lead EI Researcher	Aim of project
Linkage	4	Assoc. Prof Bertram Ostendorf; Prof Megan Lewis; and Assoc Prof Lian Pin Koh	To evaluate models site-specific management of native fauna.
		Assoc Prof Lian Pin Koh,and Assoc Prof Bertram Ostendorf	To develop an automated and distributed spatial tracking approach using low cost Unmanned Aerial Vehicles (UAVs) to locate and study endangered wildlife.
		Prof Robert Hill, Assoc. Prof Jeremy Austin, Dr Lee Arnold	This project aims to establish an open access, end-user friendly optical dating facility in Australia
		Dr Vicki Thomson, Dr Marc Jones, Dr Mark Hutchinson and Dr Kate Sanders	To test co-evolutionary processes driving venom diversity in tiger snakes
Discovery	3	Prof Ivan Nagelkerken, and Prof Bronwyn Gillanders	This project aims to forecast climate-related changes in the diversity, distribution and abundance of fisheries species
		Dr Frank Grutzner	This project will analyse the genetic and epigenetic composition and organisation of the platypus and echidna sex chromosomes.
		Assoc Prof Christian Doonan, Assoc Prof Christopher Sumby	This project aims to understand the chemistry that governs the crystallisation of metal-organic frameworks (MOF) around functional biomacromolecules and explore these bio-composites' uses.
Centre of Excellence	1	Prof Alan Cooper, and Dr Laura Weyrich Based at University of Woolongong	To encourage budding young scientists through a unique outreach program at schools and museums throughout Australia.
Future Fellowship	1	Prof Frank Grutzner	This project will analyse the genetic and epigenetic composition and organisation of the platypus and echidna sex chromosomes.

Citation statistics

Researcher	Number of citations in 2016	h-index	i10-index
ARNOLD, Lee	348	21	34
AUSTIN, Andrew D	474	47	136
AUSTIN, Jeremy J	480	33	64
BAXTER, Simon W	555	29	43
BROOKES, Justin D	589	32	64
CASSEY, Phill	909	36	113
CONNELL, Sean D	1111	50	114
COOPER, Alan	2070	69	161
COOPER, Steve J	349	36	84
DONNELLAN, Stephen C	643	39	104
FORDHAM, Damien A	359	19	40
GARCIA-BELLIDO, Diego	180	19	24
GILLANDERS, Bronwyn M	1104	50	114
GRUTZNER, Frank	498	31	50
HILL, Robert	435	49	154
KOH, Lian Pin	1601	45	93
LAMBERT, Martin F	982	32	75
LEWIS, Megan M	194	19	28
LOWE, Andrew J	1087	46	113
MAIER, Holger R	1344	48	140
MCINERNEY, Francesca	370	16	17
MEYER, Wayne S	231	30	78
NAGELKERKEN, Ivan A	885	49	104
REITH, Frank	238	21	32
RUSSELL, Bayden D	603	28	46
SANDERS, Kate L	344	18	23
TIBBY, John C	227	26	47
WAYCOTT, Michelle	1115	35	67
WEINSTEIN, Philip	597	38	135
WESTRA, Seth P	382	20	30

Board members

Professor Bob Hill

Director, Environment Institute

Bob is the Executive Dean of the Faculty of Sciences at the University of Adelaide, and Director of the Environment Institute. Professor Hill 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.

Dr Steve Morton

Advisory Board Chair, Environment Institute

Honorary Fellow, CSIRO Ecosystems Sciences

Dr Steve Morton is an Honorary Fellow with the CSIRO Sustainable Ecosystems in Alice Springs in the Northern Territory. As well as being chair of the Advisory Board for the Environment Institute, he is also Director of Bush Heritage Australia, a Board Member of Desert Knowledge Australia, Director on the Board of Territory Natural Resource Management and Chair of the Seven Member Lake Eyre Basin Scientific Advisory Panel. He is interested in the ecology of Australian deserts, science of Indigenous advancement, and the use of R&D for natural resource management.

Professor Mike Brooks

Deputy Vice Chancellor and Vice-President (Research), University of Adelaide

Professor Mike Brooks is the Deputy Vice-Chancellor and Vice-President (Research) at the University of Adelaide. He is a leading international researcher in computer vision and image analysis. His work has seen wide commercial use in the security and defence industries and has resulted in international awards. Professor Brooks has published many influential papers in the areas of auto-calibration, structure from motion and video surveillance. He is a Fellow of the Australian Computer Society, a Fellow of the Australian Academy of Technological Sciences and Engineering, Associate Editor of the International Journal of Computer Vision, and serves as a non-executive director on several boards.

Ms Sandy Carruthers

Director, Science, Department of Environment, Water and Natural Resources

Sandy is the Director of Science for the Department of Environment, Water and Natural Resources (DEWNR). Through her role, Sandy is accountable for the coordination and delivery of DEWNR'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 DEWNR, to support the critical relationships between DEWNR and the South Australian research sector.

Dr Susannah Eliott

Chief Executive Officer, Australian Science Media Centre

Susannah Eliott 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.

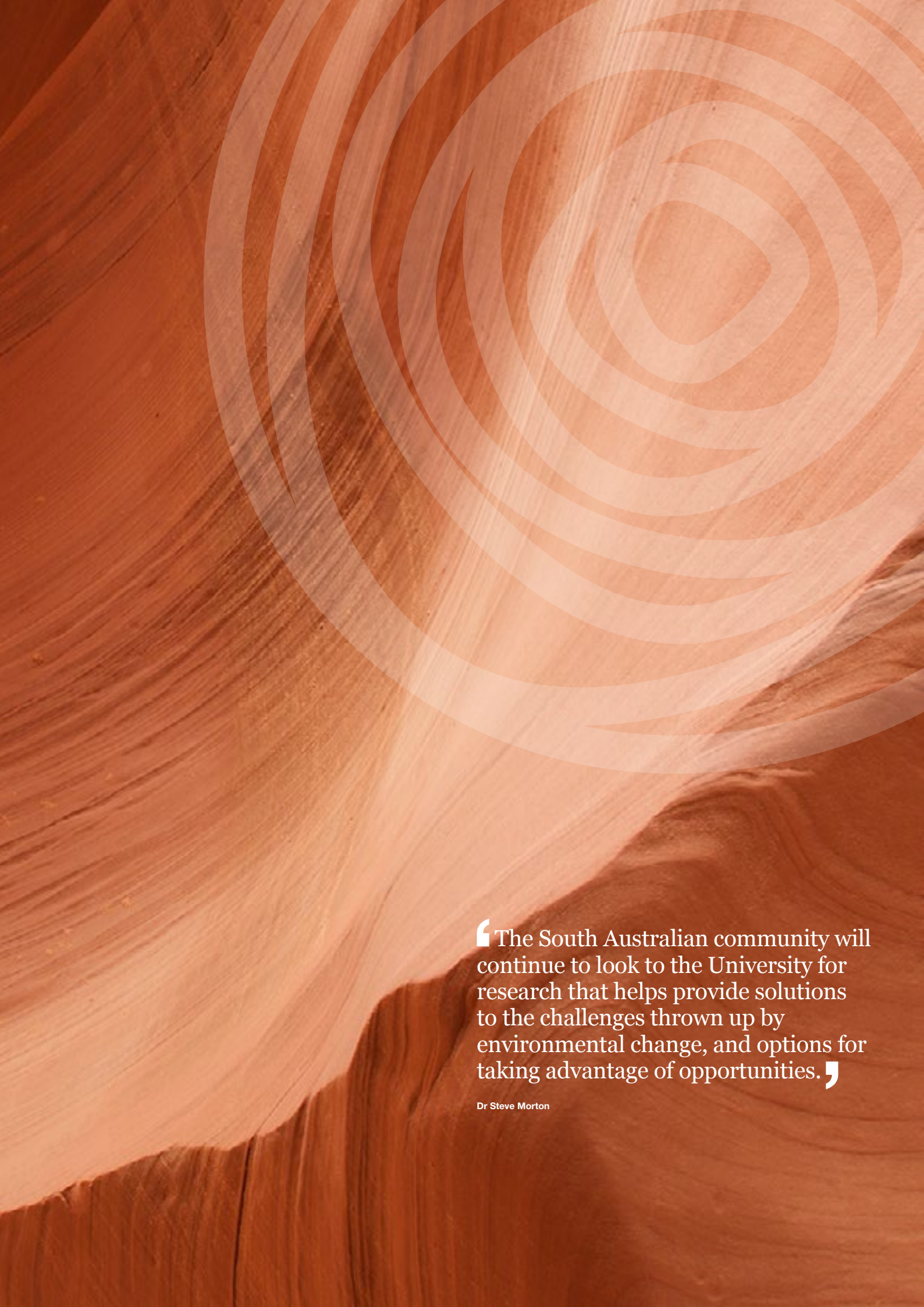
Mr Allan Holmes

Allan Holmes has been a career public servant with more than 35 years of service in Victoria and South Australia. He recently left government after 15 years as chief executive of the South Australian Department of Environment, Water and Natural Resources. He has worked in biochemistry, agriculture, environment protection, forestry, park management and nature conservation. He currently chairs Nature Play SA, is a board member of the SA Environmental Protection Agency as well as Arid Recovery Inc. and consults intermittently. Allan is an active contributor to public discussion of environmental matters.

Ms Pauline Gregg

General Manager (Environment) Telstra

Pauline Gregg is Telstra's General Manager (Environment) and is responsible for their environmental strategy. Pauline has over 20 years experience in environmental sustainability in both the public and private sectors. Pauline is passionate about educating companies on the importance of the environment in their operations. Pauline's interest in the environment has seen her take on an advisory role to the Board of the Environment Institute.



“The South Australian community will continue to look to the University for research that helps provide solutions to the challenges thrown up by environmental change, and options for taking advantage of opportunities.”

Dr Steve Morton

Our leading members

Professor Bob Hill
Director, Environment Institute

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

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

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

Professor Peng Bi
Professor of Public Health

Professor Justin Brookes
Director, Water Research Centre

Associate Professor Phill Cassey
Director, Conservation Science and Technology

Professor Sean Connell
Marine Biology Research Leader

Professor Alan Cooper
Director, Australian Centre for Ancient DNA

Professor Steven Cooper (Adjunct)
Principal Researcher, SA Museum

Professor Stephen Donnellan
Genetics and Evolution, SA Museum

Professor Frank Grutzner
Genetics Lecturer

Professor Megan Lewis
Spatial Science Research Group

Professor Andy Lowe
Director, Conservation Science and Technology

Professor Holger Maier
Civil, Environmental and Mining Engineering

Dr John Tibby
Director, Sprigg Geobiology Centre

Professor Michelle Waycott
Chief Botanist, State Herbarium of South Australia

Professor Philip Weinstein
Director ABC Centre

Associate Professor Seth Westra
Civil and Environmental Engineering

Independently funded research fellows

Dr Lee Arnold
ARC Future Fellow

Dr Simon Baxter
ARC Future Fellow

Dr Damien Fordham
ARC Future Fellow

Dr Diego Garcia-Bellido
ARC Future Fellow

Associate Professor Lian Pin Koh
ARC Future Fellow

Dr Liz Reed
Research Fellow

Dr Frank Reith
ARC Future Fellow

Dr Kate Sanders
ARC Future Fellow

Dr Cesca McInerney
ARC Future Fellow

Associate Professor Ivan Nagelkerken
ARC Future Fellow

Selected Publications

The following list comprises a selection of the Environment Institute's publications from 2016. The leading research from the Environment Institute is shown in bold type and the journals are listed alphabetically by journal type.

- Burivalova, Z., Hua, F., **Koh, L. P., Garcia, C.**, & Putz, F. (2016). A Critical Comparison of Conventional, Certified, and Community Management of Tropical Forests for Timber in Terms of Environmental, Economic, and Social Variables. *Conservation Letters.*
- **García-Díaz, P.**, Ross, J. V., Woolnough, A. P., & Cassey, P. (2016). The Illegal Wildlife Trade Is a Likely Source of Alien Species. *Conservation Letters*.
- Giam, X., Mani, L., **Koh, L. P.**, & Tan, H. T. W. (2016). Saving Tropical Forests by Knowing What We Consume. *Conservation Letters*, 9(4), 267-274.
- **Doubleday, Z. A.**, Prowse, T. A. A., Arkhipkin, A., Pierce, G. J., Semmens, J., Steer, M., . . . **Gillanders, B. M.** (2016). Global proliferation of cephalopods. *Current Biology*, 26(10), R406-R407.
- Hodgson, J. C., & **Koh, L. P.** (2016). Best practice for minimising unmanned aerial vehicle disturbance to wildlife in biological field research. *Current Biology*, 26(10), R404-R405
- Lee, J. S. H., **Koh, L. P.**, & Wilcove, D. S. (2016). Junking tropical forests for junk food? *Frontiers in Ecology and the Environment*, 14(7), 355-356.
- Black, B. A., Griffin, D., van der Sleen, P., Wanamaker, A. D., Speer, J. H., Frank, D. C., . . . **Gillanders, B. M.** (2016). The value of crossdating to retain high-frequency variability, climate signals, and extreme events in environmental proxies. *Global Change Biology*, 22(7), 2582-2595.
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