THE UNIVERSITY of ADELAIDE

Annual Report 2022

Environment Institute

make history.

2022 at a glance

37
Professorial Researcher Leaders

$7m
Research income

6 Research Initiatives

- Environmental and Wildlife Crime
- Biodiversity and Climate Adaptation and Rewilding
- Marine & Coastal Ecosystem Restoration
- Green Urban Futures and Planetary Health
- Citizen Science & Engagement
- EnviroTech to Natural Capital

Australian Research Council Funding Outcomes

4
Discovery Projects

1
Future Fellowship

Publications
Our 110 research leaders have produced the following publications in 2022:

597
Journal articles

3
Books

27
Conference items and papers

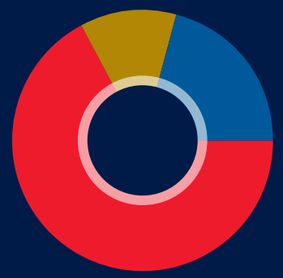
28
Expert reports to external bodies

Articles in High Impact Factor Journals

19
15+ JIF* publications

67
10-14.99 JIF* publications

90
6-9.99 JIF* publications



Membership breakdown by Faculty**

12%	Health and Medical Sciences
21%	Arts, Business, Law & Economics
67%	Faculty of Sciences, Engineering &Technology

*Journal impact factor
**As at December 2022

Contents

“I believe we have built an open and inclusive community and a sense of belonging for researchers.”

Professor Andy Lowe
Interim Director, Environment Institute

Photo: Rebecca Boulton
Cover photo: Darcy Whittaker

About the institute

The Environment Institute is committed.

Mission

Our mission is to safeguard the environment now for future generations.

Vision

We deliver the knowledge needed to halt and reverse environmental decline and ensure/influence a future that is healthy, diverse and equitable.

Connecting knowledge to lead change

The Environment Institute is driving transformational change by connecting the knowledge and thought leadership of our researchers to the world's most critical and complex environmental issues.

We are unwavering in our commitment to identifying actionable solutions that will safeguard the environment and deliver tangible and lasting economic, societal, and cultural benefits.

Our multidisciplinary work encompasses the world's critical land, air, and water resources with a common and unrelenting focus on halting and reversing environmental decline to create a better future for all.

We will achieve that by working in partnership with industry, government, and the community.

We have experts in the themes of:

- Climate & biodiversity
- Marine & freshwater ecosystems
- Urban & production landscapes
- Water quality & supply
- Citizen Science

Photo: Darcy Whittaker

2022 highlights

- **Professor Seth Westra** announced as a new University of Adelaide HiCite.
- A prestigious Australian Research Council Future Fellowship was awarded to **Dr Alec Zuo** for 'Quantifying the economic and social impacts of drought in rural Australia'.
- **Associate Professor Phill Cassey** is the University of Adelaide's lead for the ARC Special Research Initiative in Excellence in Antarctic Science Securing Antarctica's Environmental Future.
- **Professor Seth Westra** appointed as Research Director and University of Adelaide lead for the One Basin CRC.
- **Professor Timothy Cavagnaro** will lead the project 'Past, present and future drivers of soil change', which secured $3M Federal Government's Soil Science Challenge program.
- The following members received ARC Discovery Project funding: **Professor Peng Bi, Professor Steven Cooper, Professor Andrew Austin, Professor Frank Grutzner, Professor Ivan Nagelkerken and Professor Sean Connell**.
- **A/Professor Phill Cassey** and **Professor Patrick O'Connor** elected as councillors in the newly established Biodiversity Council and EI Advisory Board Chair **Professor Hugh Possingham** on the Board.
- Subak Australia Fellowships were awarded to **Dr Dominic McAfee**, **Dr Andrew Thornhill** and **Dr Stuart Brown**.
- **Dr Alice Jones** and **Associate Professor Jason Tanner** (Marine Ecosystems Program, SARDI) received $1.97M in funding from the Australian Government Department of Agriculture, Water and the Environment's Blue Carbon Ecosystem Restoration Grants program for a project titled 'Seagrass restoration the Gulf of St Vincent'.
- **Dynamic State** was held at Ukaria, in the Adelaide Hills. This event brought together a group of 120 scientific, artistic, entrepreneur, community and local government network leaders to consider the global megatrends and challenges facing South Australia and the local solutions that could be developed and actioned.

Overviews

Deputy Vice Chancellor (Research) and Pro Vice-Chancellor (Research Excellence)

The University of Adelaide has a strong commitment to research excellence that is distinguished by its international standing, dedication to innovation and excellence in research and teaching. More than 4000 research staff and students are working together, supported by modern infrastructure and an innovative culture, to tackle research challenges and deliver positive impacts both locally and globally.

As a University we have a long history of 'collaborative innovation' that benefits our partners, our state, our nation and the global community. It is a principle that we hold dearly and one that is central to our goal of making history. The Research Institutes are a fundamental element of our approach to collaboration both within the University and externally with our many partners. The Institutes provide critical opportunities for our staff and students to take a multidisciplinary approach to responding to sector and community challenges.

Under the leadership of Interim Director Professor Andy Lowe, 2022 was another successful year for the Environment Institute. Its vibrant membership across the three faculties of the University demonstrates its commitment to working together on research that delivers economic, social, and environmental benefits to the community in climate and biodiversity, marine & freshwater ecosystems, sustainable urban and production landscapes, water quality and supply.

The 2022 Annual Report highlights the activities, successes and stories of the Environment Institute's positive impact and engagement. The Environment Institute is to be commended for its participation in several significant research programs including safeguarding the environmental and commercial future of the Murray-Darling Basin, exploring how an unregulated wildlife trade threatens conservation and environmental security, and engaging with youth on the 'Trees for Good' project. Its Advisory Board Chair, Professor Hugh Possingham, and other members were also elected as councillors on the newly established Biodiversity Council.

The year 2022 saw the development of the University's FAME Sustainability Strategy, and the Environment Institute will play a critical role in the research mission that focuses on planetary health, including the restoration and resilience of biodiversity and ecosystems. It will also champion Indigenous and traditional knowledge to strengthen ecological research.

The Environment Institute continues to engage with the public through a number of citizen science projects, including EchidnaCSI and iBandi. These projects have enabled people of all ages to become involved in research and make a remarkable difference in collecting useful data that would not be available to our researchers in any other way.

We are proud of the positive impact that the Environment Institute is having across our ecosystems here in South Australia to deliver solutions for maintaining and enhancing planetary health and biodiversity.

Professor Anton Middelberg
Deputy Vice-Chancellor and
Vice-President (Research)

Professor Laura Parry
Pro Vice-Chancellor (Research Excellence)

"The year 2022 saw the development of the University's FAME Sustainability Strategy, and the Environment Institute will play a critical role in the research mission that focuses on planetary health, including the restoration and resilience of biodiversity and ecosystems."

Photo: Annemarie Gaskin

Advisory Board Chair

The Advisory Board is excited and impressed by the progress that the Environment Institute has made over the past year.

During a decade of service, Professor Bob Hill set an outstanding platform for the Institute – galvanising the hearts and minds of a breadth of researchers to tackle interesting and important environmental problems while nurturing early and mid-career researchers. These efforts and the investment from the University are now bearing fruit and what we should expect to see soon is an increase in global rankings for The University of Adelaide and an impact on policy and management. Professor Andy Lowe is building on Bob's legacy and introducing more mechanisms by which the Institute can cooperate and hopefully win more major national research grants.

It is a very exciting time to be involved in applied environmental science research. The coupled existential crises of climate change and biodiversity loss are increasingly being recognised by industry and governments around the world. While Australia at some levels has been late to the party, The University of Adelaide now has local, state and federal partners who are committed to sustainable development bounded by net zero emissions and zero extinctions. The commitments to strong environmental outcomes will drive new research and new industry.

The diversity of skills amongst Environment Institute staff – from water and engineering, to ecology and law, puts them in an excellent position to take part in the new green economies. Taking these opportunities and working in long-term partnerships with First Peoples, business, not-for-profits and governments will be essential to deliver impact from research. Further, finding and retaining partners through excellent communications – a major item of discussion by the Board in the past year – is paramount. Researchers have not always been the best communicators to the wider community, and it is pleasing to see the Institute embrace a diversity of tools from blogs and articles in The Conversation, to more traditional vehicles like radio and web-based material.

We are excited about the year ahead.

Professor Hugh Possingham FAA FNAS
Advisory Board Chair and
Emeritus Professor

"It is a very exciting time to be involved in applied environmental science research."

Photo: Tom Hunt

Celebrating success is a key element of culture, and we have seen some outstanding recognition of members this year, at global, national and local scales, including pleasingly many early career researchers."

Professor Andy Lowe

Director

With so many dedicated researchers and initiatives developing, it has been an honour and a privilege to be interim Director of the Environment Institute during 2022. It's hard to do justice to all our activities – but I'll give it a go – outlined through our pillars of: culture and people; research excellence; and communication, engagement and partnerships.

Culture and people

I believe we have built an open and inclusive community and a sense of belonging for researchers supported by the Environment Institute, including through our early, mid and senior-career researcher training, mentoring and strategy sessions. Celebrating success is a key element of culture, and we have seen some outstanding recognition of members this year, at global, national and local scales, including, pleasingly, many early career researchers.

Research excellence

Research excellence is a key pillar of our university, and our members achieved some outstanding results this year. Our ARC success was exceptional and included a Future Fellowship awarded to Dr Alec Zuo. We also saw members provide leadership in several large grant awards.

In 2022 we focused support around six research initiatives focusing on halting unsustainable species loss and exploitation and developing the research to underpin ecosystem management and restoration programs.

1. **Environmental and Wildlife Crime:** Our teams are actively building new programs to halt illegal wildlife trade, illegal logging and unsustainable fisheries extraction. Read more about this in 'Wildlife trade threatening unprotected animals'
2. **Biodiversity and Climate Adaptation and Rewilding:** We are developing new modelling and eDNA approaches to understand adaptation pressures and monitor biodiversity and are working to design resilient ecosystems in the face of natural disasters such as fire and flood. Explore this further in 'Ocean warming threatens richest marine biodiversity'
3. **Marine and Coastal Ecosystem Restoration:** We are using underwater sound and other technologies to rebuild the lost oyster reefs and marine ecosystems of Australia. We held a successful Q&A session on the reefs for the University's Sustainability Week.
4. **Green Urban Futures and Planetary Health:** We are optimising urban tree planting and green space and water scape design in cities and industrial contexts to reduce the impact of climate change and improve health outcomes for people.
5. **Citizen Science and Engagement:** We are building scale around our significant citizen science programs (e.g. Echidna CSI, Insect investigators, iBandi) and are poised to take a national leadership role. Fungi Map was nominated in Citizen Science category the 2022 Australian Museum Eureka Awards.
6. **EnviroTech to Natural Capital:** We are developing new standards, measurements methods and policy capabilities for the rapidly developing natural capital markets.

These initiatives are also helping support several large-scale research bids for submission in 2023, including three CRC bids which we are leading, supporting or have laid the foundations for: Green Economy Transition, Economic Participation of Indigenous Communities and Scaling Green Hydrogen (led by the Institute of Sustainability, Energy and Resources) respectively.

Communication, engagement and partnerships

I'm a strong believer in the importance of communication of our research and engagement with partners. This activity can take many forms beyond academic papers, many of which are able to capture public imagination (e.g though art and music) and help promote the hope and wonder of biodiversity and our environment. From youth engagement through the 'Trees for Good' program to whole of state think tanks of Dynamic State. I hope you'll explore these and more activities further on page 11.

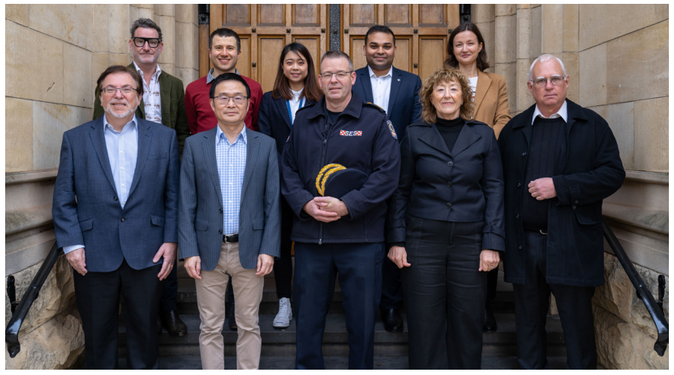
Thanks to our Advisory Board members, for actively engaging and providing strategic advice, Environment Institute Management Committee and four Theme Leads

I also want to acknowledge and thank **Professor Bob Hill** whose work as Institute Director up until 2021 laid the foundation for many of the outcomes reported here. I'm grateful for our EI professional staff for making the magic happen, and our consultants, contractors and casual staff for helping deliver the excellent outcomes.

Professor Andrew (Andy) Lowe
Director

Awards & achievements

Congratulations to Environment Institute members on their outstanding awards and achievements



The Extreme Heat and Health Adaptation Team including Professor Dino Pisaniello and Professor Peng Bi (front left).

Australian Museum Eureka Prize

Eureka Prize finalists – Innovation in Citizen Science
Dr Jasmin Packer

Eureka Prize finalists – Excellence in Interdisciplinary Scientific Research: The Extreme Heat and Health Adaptation Team
Professor Peng Bi and Professor Dino Pisaniello.

Australian Navy Commendation

Recognising their efforts to identify Able Sean Thomas Clark.
Professor Jeremy Austin and team

L to R: Associate Professor Jeremy Austin accepts the commendation from Vice Admiral Noonan on behalf of the ACAD team.

XPrize Carbon Removal Award 2025

One of top 60 finalists
University of Adelaide in a team with Seawater Greenhouse and University of Birmingham, UK.

Centre for Invasive Species Solutions

Distinguished Alumni Award
Dr Pablo García-Díaz

Leadership Development Bursary
Dr Adam Toomes and PhD student Katherine Hill

L to R: Katherine Hill, Associate Professor Phill Cassey & Dr Adam Toomes.

Green Industries SA's Circular Economy Student Award

PhD student Liancheng Li

SA Tall Poppy Award

Dr Erinn Fagan Jefferies

The Advertiser's 40 movers and shakers under 40

Dr Erinn Fagan-Jeffries

South Australian 7 News Young Achiever Awards

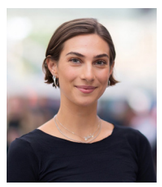
University of Adelaide STEM Award
Dr Nicole Foster

Three Minute Thesis (3MT) final (University of Adelaide)

People's Choice and Student's Choice awards
PhD student Isobel Hume

L to R: Dr Susan Close, Deputy Premier, Liancheng Li & Minister for Climate, Environment, and Water.

Dr Erinn Fagan-Jeffries



Isobel Hume, PhD student

Institute engagement

Environment Institute members were active in participating in public engagement and partnership opportunities in 2022:

Event

February

Electric dreams: Anthropocene in C Major, Professor Melissa Nursey-Bray

June

Stories from 2030 Disruption – Acceleration – Transformation (World Environment Day), Professor Andy Lowe

Uraidla Sustainability Fair, Professor Andy Lowe

August

Trees for Good Project, Professor Bob Hill

September

Royal Adelaide Show, Professor Volker Hessel

Pints of Ideas: Youth Agency on Sustainability, Professor Andy Lowe

Regenerating Australia Screening and Dynamic Statement Consultation Release, Professor Andy Lowe

Rewilding the Oceans: Combining Marine Biology and Technology, Public and Policy Q&A, Professor Andy Lowe, Professor Sean Connell and PhD student Erin Pichler

November

Finding the Fab Five Competition and Exhibition Launch, Professor Melissa Nursey-Bray

Finding the Fab Five competition winner Bella from Kangaroo Island.

Symposium

June

Dynamic State – An event that brought together a range of Environment Institute members with other thought leaders to conceptualise a sustainable future.

Miyawaki mini forests and smart green networks symposium, Dr Scott Hawken

October

Treenet Symposium 2022, Professor Bob Hill

Public Lecture

August

Network Governance for Urban Infrastructure Resilience to Disasters, Dr Naim Kapucu

Conceptualising and assessing the Diverse Values of Nature: Main Insights from the IPBES Values Assessment, Summary for Policy Makers, Professor Christopher Raymond

ARC funding outcomes

Type	Announced	EI Investigator(s)	Aim of Project	Amount
Future Fellowship	1	Associate Professor Alec Zuo	Quantifying the economic and social impacts of drought in rural Australia.	$1,035,279
Discovery Project	4	Professor Peng Bi	Mapping climate change vulnerability of older Australians to extreme heat.	$461,134
		Professor Steven Cooper & Emeritus Professor Andrew Austin	Evolution of sensory systems in the dark biosphere.	$426,591
		Professor Frank Grützner	Structural and molecular studies of endocrine disruption in Australia fauna.	$563,171
		Professor Ivan Nagelkerken & Professor Sean Connell	How climate-resilient are our temperate fisheries species?	$510,893

Top 10 2022 publications

Photo: Darcy Whittaker

The following list has been compiled from Altmetrics and comprises our top 10 publications that have attracted online attention and around the world. *Environment Institute* researchers are shown in bold type and articles are listed based on their Altmetric attention score.

1. Cox, N, Young, BE, Bowles, P, Fernandez, M, Marin, J, Rapacciuolo, G, Böhm, M, Brooks, TM, Hedges, SB, Hilton-Taylor, C, Hoffmann, M, Jenkins, RKB, Tognelli, MF, Alexander, GJ, Allison, A, Ananjeva, NB, Auliya, M, Avila, LJ, Chapple, DG, Cisneros-Heredia, DF...**Sanders, KL** 2022.. '*A global reptile assessment highlights shared conservation needs of tetrapods*', Nature, pp. 1–6, viewed 30 April 2022, nature.com/articles/s41586-022-04664-7
2. Slimak, L, Zanolli, C, Higham, T, Frouin, M, Schwenninger, J-L, **Arnold, LJ**, **Demuro, M**, Douka, K, Mercier, N, Guérin, G, Valladas, H, Yvorra, P, Giraud, Y, Seguin-Orlando, A, Orlando, L, Lewis, JE, Muth, X, Camus, H, Vandevelde, S & Buckley, M 2022, '*Modern human incursion into Neanderthal territories 54,000 years ago at Mandrin, France*', Science Advances, vol. 8, no. 6.
3. Folwell, MJ, **Sanders, KL**, Brennan, PLR & Crowe-Riddell, JM 2022, '*First evidence of hemiclitores in snakes*', Proceedings of the Royal Society B: Biological Sciences, vol. 289, no. 1989.
4. Andrzejaczek, S, Lucas, TCD, Goodman, MC, Hussey, NE, Armstrong, AJ, Carlisle, A, Coffey, DM, Gleiss, AC, Huveneers, C, Jacoby, DMP, Meekan, MG, Mourier, J, Peel, LR, Abrantes, K, Afonso, AS, Ajemian, MJ, Anderson, BN, Anderson, SD, Araujo, G, Armstrong, AO, **Gillanders, BM**... & Curnick, DJ, 2022, '*Diving into the vertical dimension of elasmobranch movement ecology*', Science Advances, vol. 8, no. 33.
5. Hasterok, D, Halpin, JA, **Collins, AS**, Hand, M, Kreemer, C, Gard, MG & Glorie, S 2022, '*New Maps of Global Geological Provinces and Tectonic Plates*', Earth-Science Reviews, vol. 231, p. 104069.
6. **McAfee, D**, Williams, BR, McLeod, L, Reuter, A, Wheaton, Z & **Connell, SD** 2022, '*Soundscape enrichment enhances recruitment and habitat building on new oyster reef restorations*', Journal of Applied Ecology.
7. **Souilmi, Y**, Tobler, R, Johar, A, Williams, M, Grey, ST, Schmidt, J, Teixeira, JC, Rohrlach, A, Tuke, J, Johnson, O, Gower, G, Turney, C, Cox, M, Cooper, A & Huber, CD 2022, '*Admixture has obscured signals of historical hard sweeps in humans*', Nature Ecology & Evolution, vol. 6, no. 12, pp. 2003–2015.
8. Roca-Rada, X, Tereso, S, Rohrlach, AB, Brito, A, Williams, MP, Umbelino, C, Curate, F, Deveson, IW, **Souilmi, Y**, Amorim, A, Carvalho, PC, **Llamas, B** & Teixeira, JC 2022, '*A 1000-year-old case of Klinefelter's syndrome diagnosed by integrating morphology, osteology, and genetics*', The Lancet, vol. 400, no. 10353, pp. 691–692, viewed 4 September 2022, thelancet.com/journals/lancet/article/PIIS0140-6736(22)01476-3/fulltext
9. Joseba Rios-Garaizar, Iriarte, E, **Arnold, LJ**, Sánchez-Romero, L, Marín-Arroyo, AB, Aixa San Emeterio, Asier Gómez-Olivencia, Pérez-Garrido, C, **Demuro, M**, Isidoro Campaña, Bourguignon, L, Benito-Calvo, A, Iriarte, G, Arantza Aranburu, Amaia Arranz-Otaegi, Garate, D, María Silva-Gago, Lahaye, C & Ortega, I 2022, '*The intrusive nature of the Châtelperronian in the Iberian Peninsula*', PLOS ONE, vol. 17, Public Library of Science, no. 3, pp. e0265219–e0265219.
10. Gierus, L, Birand, A, Bunting, MD, Godahewa, GI, Piltz, SG, Oh, KP, Piaggio, AJ, Threadgill, DW, Godwin, J, Edwards, O, **Cassey, P**, Ross, JV, **Prowse, TAA** & Thomas, PQ 2022, '*Leveraging a natural murine meiotic drive to suppress invasive populations*', Proceedings of the National Academy of Sciences, vol. 119, no. 46.

One Basin CRC success

The University of Adelaide will play a key role in a new multi-million dollar collaborative research program set up to safeguard the environmental and commercial future of the Murray-Darling Basin.

A $50 million grant from the Federal Government's Cooperative Research Centre Program and another $106.5 million from 85 partners will fund the new One Basin Cooperative Research Centre (CRC).

The national multi-partner body will create and assess new sustainable water and agricultural solutions and drive adoption by water managers and farmers to both increase agricultural output and improve environmental outcomes. One of its regional hubs will be at Loxton in South Australia.

The national consortium also includes: the University of Melbourne; the Goyder Institute for Water Research and its affiliates; the Australian National University; Charles Sturt University; Hort Innovation; the Murray-Darling Basin Authority; Sensand Technologies and the University of Sydney - and aims to "develop and commercialise opportunities for Australia's irrigated agriculture and rural water industries to be more productive, resilient and sustainable".

Interim CEO Professor Mike Stewardson said the One Basin CRC would pave the way to transform irrigation regions across Australia and internationally through innovation of water, agriculture and energy technology, enhanced forecasting and decision-making capacity and pathways to adoption and commercialisation.

"Australia's irrigation regions are the powerhouse of Australia's agricultural sector producing 50 per cent of Australia's agricultural profits, with the Murray-Darling Basin being the focus of two thirds of that irrigated agriculture," Professor Stewardson said.

It's predicted that the measures could generate significant economic benefit.

The Environment Institute's Professor Seth Westra, Research Director with the new body, said the group would "bring welcome benefits not only to South Australia but the entire Murray-Darling basin". He will head up the Technology and Opportunities program: one of the three programs of the CRC.

"I'm incredibly excited by this once-in-a-generation opportunity to build genuine partnerships between local communities, First Nations groups, governments, industry and research organisations, and collectively shape a more resilient and productive future for the Basin," he said.

Regionally based research and development will support innovation and adoption by farmers and communities, resulting in more resilient farms and diversified income streams. Regions will benefit from job growth and socio-economic improvements.

Over its 10-year term, One Basin CRC's activities will be concentrated across four regional basin hubs located at Loxton, Mildura, Griffith in south-western NSW and Goondiwindi in southern Queensland. The Lower Basin Hub based at the Loxton Research Centre in South Australia, for example, will be critical for identifying and realising future opportunities for the Basin. Loxton Hub interim leader Kym Walton said: "The Lower Basin Hub will build on existing collaborations in the region to work on local priorities that inform outcomes for the entire basin."

One Basin Chair-elect Dr Wendy Craik AM said First Nations participation would be an important part of the new body's focus.

Regional basin hubs will host 75 per cent of the CRC's activities, working directly with industry, businesses, First Nations, community and government (local, state and federal). The Loxton hub will include a consortium of local industries and partners and collaborators of the Goyder Institute, including the University of Adelaide, Flinders University, the South Australian Research and Development Institute, the CSIRO, the Department for Environment and Water and the Department of Primary Industries and Regions (PIRSA).

Safeguarding our oceans

At the Environment Institute, we continue research work to help safeguard our oceans. Our Marine and Freshwater Ecosystems Theme and researchers are making great strides in advancing blue carbon ecosystem restoration efforts and developing improved understanding of species changes as a response to ocean acidification.

Seagrass restoration in Gulf St Vincent

Twenty hectares of seagrass will be restored in the Gulf St Vincent off Port Gawler, north of Adelaide, as part of a project involving the University of Adelaide and the South Australian Research and Development Institute (SARDI), the research division of the Department of Primary Industries and Regions (PIRSA). The 'Gulf St Vincent Seagrass Restoration' Project secured $1,972,500.00 in funding from the Australian Government Department of Agriculture, Water and the Environment's Blue Carbon Ecosystem Restoration Grants program. Dr Alice Jones will lead the ecosystem functioning and carbon capture elements of the project.

Kelp ecosystem change at an underwater CO^2 vent. Photo: Professor Ivan Nagelkerken, the University of Adelaide.

Seagrasses provide a range of essential functions to the marine ecosystem, including as a food source and habitat for various species, reducing coastal erosion and storing significant amounts of carbon (known as 'blue carbon') longer than terrestrial systems.

Once seagrass is lost, ocean sediment becomes loose and reduces the ability for seagrass seedlings to recolonise. The project involves dropping 100,000 biodegradable hessian sandbags on the seafloor to allow wire weed seagrass seedlings to attach to them naturally. The bags provide a stable environment for seedlings to establish, and the hessian naturally degrades. The advantage to the approach is there is no need to use divers, it costs less than 10 per cent of traditional restoration techniques and avoids disturbing remaining seagrass beds to obtain planting material.

The Gulf St Vincent Seagrass Restoration Project will examine how effectively the restored patches operate as habitats for fauna, and in accumulating blue carbon, to ensure that seagrass rehabilitation not only restores the actual seagrass, but the functions that the habitat provides in the environment.

Changes in marine ecosystems going undetected

Rising sea temperatures are causing lasting damage to many of the world's significant ecosystems, including coral reefs and kelp forests. Climate change due to human activity has a direct impact on marine species. It alters their abundance, diversity, distribution, feeding patterns, development and breeding, and the relationships between species are affected.

Professors Ivan Nagelkerken and Sean Connell and their research team investigated how species communities located around undersea volcanic CO2 vents and in laboratory mesocosms respond to changes in climate. They reviewed 58 research studies that examined communities in different types of temperate reefs, coral reefs and seagrass beds, and 23 studies carried out in outdoor experimental environments or laboratories. Their research showed that in cases where standard biodiversity metrics show no change or little change, there may still be reorganisation of ecological communities in our oceans.

Their findings have significant implications for future projections of ecosystem change and stability and suggest that monitoring the impact of ocean acidification will be more meaningful if there is a focus on detecting species replacements and changes to the abundance of species rather than testing for signs of habitat loss or biodiversity loss.

Further reading:

Nagelkerken, I. and Connell, S.D. (2022). *'Ocean acidification drives global reshuffling of ecological communities'*. Global Change Biology, 48(23). doi:https://doi.org/10.1111/gcb.16410.

Wildlife trade threatening unprotected animals

International trade in animals not regulated by multilateral agreements is putting them under increasing threat.

Have you ever wanted a two-toed sloth for a pet? How about a Chinese water dragon? Well, if you live in the United States you might just have a chance of snagging one of these exotic species. New research from the University of Adelaide's Invasion Science and Wildlife Ecology Group shows that three times as many of these unregulated species are being imported into the US compared to regulated species.

"The international wildlife trade is currently one of the leading threats to global biodiversity conservation and environmental security," says Ms Freyja Watters, who is a PhD candidate in the School of Biological Sciences.

The international wildlife trade is regulated by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). It's a large organisation with many participating countries, and it provides a regulatory framework that ensures wildlife trade is sustainable, traceable, and most importantly: legal.

But the problem is, CITES only covers 10.5% of all described "terrestrial vertebrates", and when a country tracks wildlife being imported or exported, they usually only record and monitor those animals that are covered by CITES. This could mean that the authorities have no way of knowing how many potentially endangered animals are being imported, and no way of protecting these vulnerable creatures if they're being imported unsustainably.

So, what about the other 89.5% of our terrestrial vertebrates? Ms Watters has aimed to answer this exact question, using a decade of importation data on wild animals entering the United States.

"Using this data, we found that 3.6 times the number of unregulated species were being imported into the U.S. compared with CITES-listed species (1,366 versus 378 species)," Ms Watters explains.

"Of those 1,366 species of amphibians, birds, mammals and reptiles that aren't covered by CITES, there were species at risk of extinction such as the golden gecko (Gekko badenii) and Chinese water dragon (Physignathus cocincinus), or species with small and fragmented geographic ranges like Helens flying tree frog (Rhacophorus helenae) and the Chapa Bug-eyed frog (Theloderma bicolor)."

Associate Professor Phill Cassey, co-author of the study and also from the University of Adelaide's School of Biological Sciences, explains why this kind of investigation is so important.

"No systematic alert or standard procedure exists to identify when a species may require CITES listing and it is only after the documentation of major declines in wild populations or large volumes of illegal trade seizures that many species are identified as at risk from trade," he says.

What's next?

In their paper recently published in Conservation Biology, Ms Watters and the team highlight that since affluent countries like the United States have the highest demand for these exotic species, they should take the lead in the funding and implementation of better systems to manage international wildlife trade. The important analysis conducted by Ms Watters draws attention to this specific issue, and ensures that governments may more easily be able to identify species that are at risk of exploitation, and ensure that they adopt new policies to track and protect these animals.

Originally published in the University of Adelaide Research Impact Stories.

Further reading:

Watters, F, Stringham, O, Shepherd, CR & Cassey, P 2022, '*The U.S. market for imported wildlife not listed in the CITES multilateral treaty*', Conservation Biology, vol. 36, no. 6.

Ocean warming threatens richest marine biodiversity

An international team of scientists led by researchers from the University of Adelaide has revealed that rates of future warming threaten marine life in more than 70 per cent of the most biodiverse-rich areas of Earth's oceans.

The Unviersity of Adelaide team included Environment Institute members Associate Professor Damien Fordham, Dr Camille Mellin and Dr Stuart Brown. "Our research shows that locations with exceptionally high marine biodiversity are the most exposed to future oceanic warming, making them particularly vulnerable to 21st century climatic change," said lead author Dr Stuart Brown.

"This is because species living in these biodiverse regions are generally ill-equipped to respond to large changes in temperature."

Using a new technique for comparing past and future extreme rates of oceanic warming, the researchers were able to map global exposure to future climate change and establish distances that plants and animals in vulnerable areas need to move to track suitable climatic conditions.

"In many cases this will require moving distances beyond the oceanic regions that these species evolved in and are adapted to, at rates of movement rarely seen for marine life," said Dr Brown.

The most vulnerable marine communities contain most of the world's reef-building coral species, which provide ecosystem services that support the livelihoods of millions of people. Other vulnerable regions are home to iconic marine megafauna including manatees.

"While we have known for some years that recent human-induced climate change is affecting marine life through shifts in species distributions and abundances, the spatial pattern of exposure to past and future fast rates of ocean warming has been unclear," said Associate Professor Damien Fordham.

"By showing that areas of high marine biodiversity are disproportionately exposed to future warming, our results provide important new information for deriving and strengthening conservation actions to safeguard marine biodiversity under climate change.

"Actions that strengthen ecological and evolutionary resilience to climate change should be a priority. These could include improving fisheries management, assisting the movement of species, and the expansion of well-managed, climate-smart marine protected areas."

The research published in Global Change Biology shows that even under a relatively conservative scenario of future climate change, hotspots of marine biodiversity are highly vulnerable to accelerated ocean warming.

Originally published in the University of Adelaide News.

Further reading:

Brown, SC, Mellin, C, García Molinos, J, Lorenzen, ED & Fordham, DA 2022, '*Faster ocean warming threatens richest areas of marine biodiversity*', Global Change Biology.

The value of urban trees

A multidisciplinary team from the Environment Institute is progressing our understanding of climate adaptation, the public health value of trees in our cities, and developing new ways to get community engaged in tree planting.

Professor Veronica Soebarto and team are quantifying the potential impact of increasing urban canopy cover to reduce heat-related deaths in local government areas in the Greater Adelaide Metropolitan. Using spatial analytic techniques, a recently published study evaluates the spatial variability and relationships between increased tree coverage and potential reduction of heat-related mortality rates, and takes into consideration other socio-economic and demographic risk factors. The results indicate that dramatic public health benefits are possible from increasing tree canopy coverage, emphasising an urgent need for close alignment of public health policy with urban planning and greening policies for the whole region. Their research provides a compelling case for tailoring urban greening and tree canopy enhancement at the local government level based on the socio-economic and cultural characteristics of local populations.

Professor Peng Bi and colleagues are furthering our understanding of vulnerability of older Australians to climate change and heat stress mitigation strategies that can be used, including tree planting. The team won an ARC Discovery Project this year titled 'Mapping climate change vulnerability of older Australians to extreme heat' which aims to develop this and whose outstanding work were recognised as finalists in the Eureka Prizes (Extreme Heat and Health Adaptation Team).

Dr Kate Delaporte and collaborators have also been working with local councils and utility providers to develop a list of urban tree species that can best provide multiple ecosystem services (heat adaptation, pollution and noise reduction, biodiversity habitat) whilst reducing risks (root damage, limb fall).

The Trees for Good project aims to nurture school-aged children's natural curiosity in nature to encourage tree planting and understanding of the benefits and risks to trees. It is a partnership of the Environment Institute (Professor Bob Hill), Treenet, Project Green Group, DeBill Environmental, SASTA, Port Adelaide and Enfield Council, Green Adelaide and Alberton Primary School.

The program was launched by Joe Szakacs MP, Minister for Police, Emergency Services and Correctional Services and Member for Cheltenham, together with Councillor Steve Vines from the City of Port Adelaide at Alberton Primary School. At the event, students not only named their tree (apparently Greg was a popular choice), but also learned how to measure and track its growth, its health, and the impact on the local environment. They will also be able to enter the data online to see how their tree compares to others as the program progresses.

Trees for Good is now looking to extend through further partnerships with schools, councils, businesses and individuals. But it's safe to say the seeds have been sown for the future scientists!.

Further reading:

Bartesaghi Koc, C, Soebarto, V, Hawken, S, & Sharifi, E 2022, '*The potential for urban canopy cover to reduce heat-related mortality in Adelaide*', in N Aghamihammadi, & M Santamouris (eds.), Urban Overheating: Heat Mitigation and the Impact on Health, Springer pp. 249-273.

Photo: SA Science Teacher Association

2022 leadership

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Photo: Darcy Whittaker

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Kaurna acknowledgement
We acknowledge and pay our respects to the Kaurna people, the original custodians of the Adelaide Plains and the land on which the University of Adelaide's campuses at North Terrace, Waite, and Roseworthy are built. We acknowledge the deep feelings of attachment and relationship of the Kaurna people to country and we respect and value their past, present and ongoing connection to the land and cultural beliefs. The University continues to develop respectful and reciprocal relationships with all Indigenous peoples in Australia, and with other Indigenous peoples throughout the world.