2012

ANNUAL REPORT
Environment Institute

GROUP OF EIGHT
MEMBER

ENVIRONMENT
INSTITUTE

THE UNIVERSITY
of ADELAIDE

CONTENTS

02 VISION

The Environment Institute exists to deliver outstanding research across environmental sciences.

By understanding patterns and processes to derive solutions, we help enable decision-making that can meet today's and future needs.

03 CONNECTING KNOWLEDGE TO LEAD CHANGE

Global environmental systems face ever-growing pressure. These challenges are complex. Our work supports action to develop and apply novel solutions to ensure a healthy environment, which is vital to our future prosperity and wellbeing.

To help do this, the Environment Institute links leading water and climate scientists with biodiversity, marine, landscape, biology, geology and genetics research.

From individual species to whole systems, we examine interactions using data from the distant past through to future scenarios. Similar diversity characterises the geographic extent of our projects - from detailed investigations to broad scale, worldwide analysis. This wide-ranging scope includes studying the current state of the environment, the pressures on it, proactive restoration approaches and the best ways to manage our precious natural resources.

The Institute's pioneering work is helping to develop the evidence to support government, industry and the community to make informed decisions and positively shape Australia's future.

Our environmental specialists work together on projects to deliver innovative, relevant and actionable research outcomes in areas including:

- water
- biodiversity
- conservation
- landscape transformation
- oceans and marine biology
- climate change, resilience and adaptation
- genetics, ancient DNA and DNA barcoding
- clean energy technology and carbon sequestration.

04 CHAIR'S OVERVIEW

The Environment Institute inspires a culture of innovation and collaboration that is helping to advance the University's status as a centre for research excellence.

Now it is poised for the next phase of its evolution.

Critically, the Institute brings together some of the world's leading researchers and outstanding scientific leaders who add substantive depth to the University through their considerable academic standing and research achievements.

In the next few years, we will continue to encourage and support these superb researchers. Solving complex environmental issues calls for a collective approach that builds on individual attributes to enhance our external research impact. To help do this, the Board will work with the Institute to create new external partnerships in areas of significant value to South Australia and the nation. Board members are also keen to act as mentors to its scientific leaders as they grow their skills in multidisciplinary science and apply their expertise to solve large-scale environmental problems.

Achieving these aspirations will see the University shine even more brightly in environmental research for years to come.

Dr Steve Morton
Chair, Environment Institute Board

Board Members

Dr Steve Morton (Chair)
Honorary Fellow
CSIRO Ecosystem Sciences

Professor John Beynon
Executive Dean, Engineering, Computer and Mathematical Sciences
The University of Adelaide

Carl Binning
Vice President Sustainability
BHP Billiton
(now Managing Director at Creating Communities)

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The University of Adelaide

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The University of Adelaide

Pauline Gregg
General Manager-Environment
Telstra

Allan Holmes
Chief Executive
Department of Environment, Water and Natural Resources

05 DIRECTOR'S OVERVIEW

As Acting Director during 2012, and now Director of the Environment Institute, I have had the pleasure of watching, directing and assisting its growth and development. This has been a highly successful year as we've consolidated our core research strengths and built new capacities and the foundations for strong future outcomes. I've been delighted to witness and help guide others in the application of our research as we are now seeing substantial uptake of the Institute's science across all our major focus areas. This growth and development is addressing the fundamental objectives the University of Adelaide set when establishing the Institute.

The Environment Institute comprises many talented people. Several of our research leaders detailed in this report are developing great renown. They are recognised globally as being at the top of their fields and mostly at a relatively young age. The Institute has been central to supporting their development, helping to profile the relevance and importance of the research carried out and attracting talented new people to work with us. A highlight is the level of citation of our work with two individuals (soon to be three) amongst the top one per cent in their fields.

However, individuals working on their own, regardless of their skill cannot solve today's environmental research problems. Our collaborations have expanded. They span researchers and specific external engagements, to include strong and important relationships with institutions like the South Australian Museum and South Australia's Department of Environment, Water and Natural Resources.
The Institute has also been central to fostering broad collaboration across the community and business sector. Examples include some of Australia's leading mining companies, industry and infrastructure businesses, working alongside many engaged regional partners to address future environmental pressures that may be associated with development across the Spencer Gulf region.

Importantly, the Institute's projects are reaching into complex adaptive – 'wicked' – problems. These issues typify environmental policy and its application. For example, the work of our biodiversity groups is looking at more than just empirical climate change and biodiversity relationships. For effective change, we must understand and engage in the interface between this, policy and economics. Recent work is addressing such areas across the Institute, and with research around how climate change also affects ecological systems and decision-making. Similarly, our research into productive landscapes focuses on social uptake and implementation of research, identifying a suite of options to address farm productivity, biodiversity and climate change challenges successfully.

Naturally, funding outcomes also reflect the Institute's success. While there are many examples of our robust overall performance, the outcome of the Australian Research Council's June 2012 linkage project announcement illustrates our group's strength. From this single announcement, the University of Adelaide secured 11 new grants. Institute members lead five of these, totalling nearly two and a quarter million dollars in new research. Overall, annual income for the group grew strongly.

Generally, 2012 has seen our highly cited research gain greater public and policy prominence. We have deepened our engagement with society and its interest in and use of the Institute's work. Our individual researchers have continued to excel in their fields. This demonstrates how the Institute can help enable both outstanding work and build others' capacity to apply it for substantial societal and environmental benefit.

Professor Bob Hill
Director, Environment Institute

06 | BIODIVERSITY IN A CHANGING WORLD

"We need an improved understanding of the world's biodiversity; we need to know how species will respond to environmental change, such as climate change, so that we can manage ecosystems for our future."

Professor Andy Lowe

Halting illegal trade – timber tracking

Genetic mapping of the world's trees and plantations makes it possible to analyse DNA from timber products such as wood chips, timber decking or furniture and identify the forest it came from.

Illegal logging is a major cause of deforestation and forest degradation, with between 14 and 16 million hectares of forest lost each year.

Using just a few wood shavings, our research in DNA barcoding provides ways to assess, quickly and accurately, whether wood products might come from a sustainable plantation or an illegal source in a protected area.

Product tracking using DNA barcoding technology would help to reduce the flow of endangered species into the timber market. This in turn supports the competitive advantage that industries, companies and communities may gain by managing natural resources for society's long-term benefit.

Over a relatively short time, humans have re-shaped the world to such an extent that a new geological age has been named for today – the anthropocene.

The Environment Institute conducts world-leading research into critical questions about the consequences of human activity on the living systems we rely on. Importantly, our work can help deliver practical ways to better monitor, manage and protect the health and biodiversity of ecosystems. Our research actively supports future adaptability.

For example, our researchers are discovering how our native flora and fauna work at a molecular level. We are also looking at whole systems - how plant and animal species interact within the environment and what these interrelationships mean for species and environmental health. This can help develop the best, most cost-effective measures to protect and restore natural habitats, despite pressure from human activity and a changing climate.

The Institute's innovative work in evolutionary biology, and biodiversity science and management, is making major breakthroughs in areas including:

- discovering and identifying species, their evolutionary history, relationships and change over time
- measuring and predicting the response of biodiversity and ecosystems to current and future environmental pressures
- creating effective, positive change through supporting evidence-based biodiversity and conservation management.

Together with our extensive in-house expertise, we have strong collaborative partnerships with government organisations such as the South Australian Museum, State Herbarium and the SA Department of Environment, Water and Natural Resources, as well as many corporate and non-government organisations.

Tracking change over time

The Environment Institute plays a major role in Australia's Terrestrial Ecosystem Research Network (TERN), which is transforming ecosystem science. This program assembles essential collaborative frameworks to integrate highly complex and geographically distributed environmental and ecosystem information. This enables the study of whole systems needed to understand our biodiversity challenges.

For example, the program provides the evidence needed to manage effectively for future ecosystem integrity and biodiversity recovery. As with any study into complex environmental and species interactions, TERN has several major subprograms. Transects for Environmental Monitoring and Decision Making (TREND) is just one standout example.

TREND is a unique and exciting landscape-scale research project. It provides an integrated system of data collection across bushland, farmland and marine environments to develop evidence-based recommendations, guidelines and tools to monitor change. This research will catalogue what species we have, where they live and how ecosystems are changing, providing the evidence that is fundamental to adaptive management.

By assessing the effects of potential climate and environmental shifts, TREND provides an early warning system for changes in diverse environments based on long-term monitoring.

A revolutionary approach to identifying species

DNA analysis is revolutionising our understanding of the way living systems work and how to manage biodiversity. Our researchers are international leaders in developing next generation DNA sequencing techniques. This allows analysis of a vast range of material both living and dead, including plants and animals at any life stage. One practical application is the rapid, accurate identification of species. In turn, this new technology promises to deliver results for cheaper, faster environmental impact assessment. These tools can enable tracking of the source of biological products such as timber to combat illegal trade and application to pest management and human and environmental forensics.

A leading example of this work is the development of Rapid IDentification (RapID). This collaborative national research program aims to apply DNA technology to rapid genetic species identification, producing major potential productivity gains. An initial economics study estimates the net present value of investing in this work to be more than $300 million nationally because of future improvements in biodiscovery, provenance, environmental impact assessment and biosecurity.

Ancient genes the key to current challenges

A study of ancient genetic material from the now extinct mainland Tasmanian devil showed that they had low immune gene diversity for hundreds, and possibly thousands, of years before devil facial tumour disease emerged.

Low immune gene diversity in modern devils has been linked to the spread and devastating effects of the disease. When and how devils lost their immune diversity was unknown.

Researchers examined the bones of extinct mainland devils and museum specimens of Tasmanian devils collected over the last 200 years. They found that immune diversity in devils was low in all Tasmanian samples dating from the 1980s back to before European arrival in 1800. Mainland devils, isolated from the Tasmanian population by sea level rises at the end of the last ice age, also had low and very similar diversity to Tasmanian devils.

Low immune diversity makes devils susceptible to disease, potentially explaining their history of population extinctions, population decline and disease outbreaks in the 1800s and early 1900s.

Evidence of plants' adaptation to climate change

A world-first study featuring Professor Andy Lowe discovered that recent climate change is causing the leaves of some Australian plants to narrow in size.

Researchers analysed samples of the Narrow-leaf Hopbush from the wild, and herbarium collections, dating from the 1880s to the present. The study focused on specimens from South Australia's Flinders Ranges. The research found average leaf width has shrunk by two millimetres, or 40 per cent, over 127 years across the region. Between 1950 and 2005, maximum temperatures rose by 1.2° C in South Australia but there was little change in rainfall in the Flinders Ranges.

While earlier studies have observed climate change-induced alterations in plants' flowering time and animal migration patterns, this is the first evidence of changes to plant shape.

The results increase understanding of how plants cope with changing climates and which Australian plant species may have the potential to adapt to rising temperatures.

08 | TOWARDS CLIMATE CHANGE SOLUTIONS

"We don't have a lot of time, that's the key. If we had 400 or 500 years to fix these problems we could probably take a more esoteric approach to them, but we don't, we have decades."

Professor Corey Bradshaw

Institute research focuses on understanding impacts from greenhouse gas emissions and addressing climate change.

We work to:

- support reducing carbon emissions
- understand climate change impacts on ecology, food productivity and the environmental services that underpin our economy.

The world is currently warming at a rate not seen in 800,000 years. Climate change across southern Australia means higher temperatures and likely drier conditions, along with other impacts. This puts pressure on natural and agricultural systems in this region. Similar concerns are seen across the world.

Our research projects are advancing scientific capabilities in areas like biodiversity, biosecurity (preventing and combating pest and disease threats), geobiology (the interconnectedness of organisms and earth systems), carbon sequestration and energy solutions. For example, it is important to learn more about how native and introduced species might respond to variations in climate and their capacity to adapt. Then we can identify the most vulnerable systems and regions and proactively seek to maximise the outcomes. Our interventions can take into account likely future changes.

An area of this work is looking at whole ecosystems and the ways that multiple factors might interact with climate change. Our research can take information collected on threatened species and build a model to predict future population size, extinction risk and the effectiveness of management interventions. This simulation model can look at a single species through to a spatially distributed population. We can pose new questions such as how habitat change might affect future population size, extinction risk and management interventions. The model can also consider new issues like how climate change might affect a habitat or allow for the introduction of competitive species and the ensuing effect on survival/mortality rates.

Outcomes from all of this work can address cost, climate change resilience and future biodiversity outcomes over vast landscapes.

“The latest revolution in geoscience research recognises the inseparable nature of life from the Earth system. We undertake research at the interface of life and Earth, as well as developing the understanding of how geobiological systems sustain society and can be best managed.”

Professor Martin Kennedy

Ancient clues help to predict future adaptation

Studying Earth’s ancient past is revealing how and why living systems evolve and adapt to changing environmental conditions.

Researchers, led by Professor Alan Cooper, compared changes in DNA from 30,000-year-old bison bones from the Yukon region in Canada to those in modern-day cattle to look for similarities.

Known as epigenetic changes, these heritable changes in gene expression do not alter the DNA sequence, and can occur rapidly over generations in response to environmental changes.

The study found the ancient gene patterns to be very similar to the modern ones, giving researchers a new means to study the role epigenetics may play in evolution. The results suggest environmentally induced epigenetic variations may allow animals to adapt far more rapidly than would standard mutation and natural selection, which takes many generations.

This groundbreaking work on species during the ice age confirms the genetic influence of this major set of climate fluctuations, adding to our understanding of evolutionary adaptation.

Sustainable energy options

Affordable and reliable clean energy technologies are vital to support the shift from a high to low greenhouse gas emitting society. At the same time, we can sequester and reduce emissions, while protecting or improving ecology and biodiversity. Examples include biological fuel from algae, hybrid conventional and solar heat, and biodiversity plantings to offset carbon emissions and improve the future survival chances of plants and animals.

Researchers are using advanced systems modelling techniques to explore how low-carbon energy alternatives could support industry and communities. This work includes using energy analysis scenarios to help develop hybrid systems that generate a 50 per cent renewable electricity supply with input from solar and wind sources. Researchers are also developing technologies that burn fossil fuels more cleanly and efficiently, and ways to integrate existing and new combustion systems to enable a smoother, cheaper transition to an environmentally sustainable society.

A new formula to save forests

Avoiding deforestation is vital to reducing total global greenhouse emissions, biodiversity loss and poverty.

A research team including Professor Corey Bradshaw found that financial incentives such as Reduced Emissions from Deforestation and forest Degradation (REDD) have had mixed success due to opportunity costs and administrative and technical issues.

Their proposed new model, iREDD, counters these problems by adopting key concepts from the insurance industry. This involves the buyer and seller assessing the level of risk in a forest conservation project together, agreeing on that risk and buying a suitably scaled insurance policy.

iREDD could be used to protect the interests of both the seller (representing the forest managers) and the buyer investing in the forest for its carbon offset potential.

This approach makes it more likely that atmospheric carbon will be reduced and the forest’s associated biodiversity will remain, protecting thousands of species from local extinction.

Understanding life on Earth

The Sprigg Geobiology Centre, led by Professor Martin Kennedy, brings together an interdisciplinary research group unique in Australia to study the biological and geological processes that together control the habitability of our planet. Researchers examine how organisms both alter and evolve in response to the environment, and how they control the geologic processes that influence resource distribution and environmental stability.

Launched in November 2012, the Centre was named in honour of pioneering scientist Reg Sprigg AO (1919-1994), whose discovery of Ediacaran fauna was fundamental to understanding the origin of complex life on Earth.

This geobiological record provides direct evidence of how life responds to and triggers changes in the environment, and gives the only direct insight into solving critical issues around human-induced climate change.

10 | MANAGING WATER FOR LIFE

Water is fundamental to both human and environmental health.

The Institute works with government, industry and the community to balance human and environmental needs as well as finding improvements in terms of climate change, freshwater management, human health, and seas and oceans.

Our research brings together ecologists, biochemists, hydrologists, engineers, mathematical modellers and social scientists to advance our understanding of water systems and develop innovative solutions to key water management issues including:

- the most efficient way to allocate water to catchments to optimise environmental, ecological and social outcomes
- the processes that influence water quality in catchments and also affect the marine environment
- the interactions between climate variability and change, landscape characteristics and stream flow and ways to improve rainfall-runoff-recharge-water quality relationships
- how to more efficiently plan, build and maintain water distribution assets such as underground pipes.

In South Australia, we understand that our society and economy depend on water – resources like the River Murray are a strategic asset. The Institute continues to develop significant research partnerships at a state, national and international level to support programs that optimise our water infrastructure.

Work includes the River Murray, Lake Eyre Basin and the state's South East and provides decision-makers with credible evidence to support the sustainable management of these vital natural resources.

Joint appointments with government agencies help to build an important link between knowledge and public policy adoption. Industry collaborations are a major source of innovation with proven potential to save millions of dollars in water infrastructure and maintenance costs through improved design.

Informing evidence-based water management

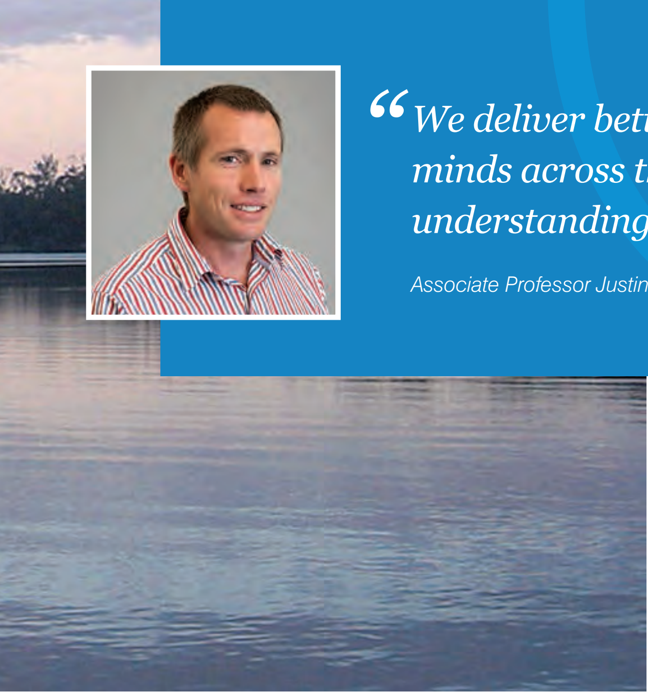
Partnering through the Goyder Institute for Water Research, the Environment Institute provides expert, independent scientific advice to solve water management problems, and to identify threats and opportunities to South Australia's water security.

Over the last century, the health of the Murray-Darling Basin has declined. The ecosystems that rely on water flowing through the Basin's rivers and tributaries face considerable pressure due to over-allocation of water resources. This problem is likely to worsen as water availability declines due to a changing climate.

In November 2011, the Murray-Darling Basin Authority released a draft plan to support the sustainable and integrated management of the Basin's water resources in a way that also meets competing social, economic and environmental needs.

As part of its response, the South Australian Government sought advice from the Goyder Institute on the plan's likely ecological consequences in South Australia.

Through an expert panel, our researchers reviewed the state government's assessment of the proposed Basin Plan and particularly the likelihood that it would meet environmental water requirements for key natural assets. These included the River Murray channel and connected streams and wetlands; the valley section floodplains (including Chowilla and other Riverland floodplains); the gorge section floodplains and the Coorong, Lower Lakes and Murray Mouth.



> *"We deliver better science by teaming with the best minds across the world to make new advances in our understanding of water systems."*
>
> *Associate Professor Justin Brookes*

Based on a review of draft technical reports produced by the SA Government, a workshop with government experts and consultation as needed with relevant agencies, the panel:

- advised on the suitability of the state government's analyses
- evaluated the likely ecological consequences of the Basin Plan's proposed 2750 GL water recovery scenario relative to a 'baseline' scenario
- recommended potential extra mitigation options to improve ecological outcomes.

The Institute also studied the options for an effective decision support framework to enable the planned, sustainable allocation of water resources in the state's South East. This system would help to solve the region's two main water management issues. Firstly, how to balance use of the groundwater resources for agriculture, industry, town water supply, stock and domestic use with environmental needs. Secondly, how best to decide which environmental assets will have water diverted to them each year via the Upper South East's extensive drainage network.

Latest technology in spatial science

Satellite and aerial remote sensing and photography, Geographic Information Systems (GIS) and spatial analysis are powerful tools to monitor and manage natural systems on a large scale. This technology is proving very successful in validating hydrological and ecological modelling.

Our researchers are using spatial science to study Australia's vast arid lands, the South Australian wheat belt, wetlands, native vegetation and fauna habitats in several bioregions and urban environments.

These projects involve mapping the condition of natural resources. Examples include soil erosion, vegetation distribution and composition, invasive species, land clearance, revegetation, habitat suitability and riverbank collapse. Using time sequences and past images, they can record variations in land cover and management, water regimes and the effects of climate change.

In the state's South East, time-series of satellite images and aerial photographs were used to study vegetation changes since 1958 and changes in the flood patterns of the Lake Hawdon wetlands since 1989. Work in this region will continue through a new Goyder Institute project to develop ecological response models and determine water requirements for wetlands.

Remote sensing used to map groundwater resources

Advanced land survey and remote sensing technologies have provided new insights into the distribution and dynamics of South Australia's mound springs, fed by the Great Artesian Basin (GAB).

Groundwater from the Basin is often the only reliable water source in the arid and semi-arid interior of central and eastern Australia. It is vital to agriculture, industry and communities. The Basin's iconic springs also support many species of great ecological, evolutionary and biogeographical significance.

Completed in 2012, the Allocating Water and Maintaining Springs in the Great Artesian Basin research project precisely mapped the locations and elevations of the GAB springs, the extent of their wetland vegetation and their surface characteristics over space and time.

This is the most comprehensive and accurate survey of the springs ever undertaken in the Basin. Based on the outcomes of this research, protocols and methods were recommended for future studies to monitor any changes in spring flows. This important baseline data will inform improved management of the GAB groundwater resources, which contribute significantly to the Australian economy, biodiversity, tourism and quality of life. The National Water Commission will publish its project report early in 2013.

12 | UNDERSTANDING THE ECOLOGY OF OUR OCEANS

"A thriving marine region, where progressive developments occur, community opportunity is optimised and the unique ecosystem is protected and enhanced, could be the ultimate outcome of our Spencer Gulf work."

Professor Bronwyn Gillanders

Coastal environments provide habitats for plants, animals and fish and play an essential role in the health of human and environmental systems.

However, they face pressure from development in industries such as mining, agriculture and transport. Critical areas such as estuaries, swamps, marshes and wetlands are breeding grounds or nurseries for nearly all marine species, including those of commercial importance. Habitat loss here impacts ocean biodiversity.

Our marine research studies the ecology of fish, invertebrates and plants in temperate marine environments – primarily around Australia – using long-term, continental-scale studies.

The focus is on understanding the relationships between marine species, their reliance within ecosystems, and the connectivity of oceans with land-based habitats. This work includes investigating the ecology of rivers, estuaries, reef systems, gulfs and open coasts using a whole-of-catchment approach. The results help to characterise and explain statistical patterns of species' abundance, distribution and diversity to inform marine habitat management.

Among our key research areas are:

- Habitats: human and climate change impacts on subtidal habitats, sea-based versus land-based catchment management, and restoring fragmented habitats
- Kelp forest ecology: macroecology patterns across Australia and processes that maintain against change
- Ocean, rivers and fisheries science: sustainability of species such as the giant Australian cuttlefish and temperate snapper, and restocking rivers with native fish.

This work is important for addressing ecosystem collapse or the drivers of collapse. It has had excellent uptake through the media and international groups interested in managing local stressors to counter the impacts of global stressors. An example is when carbon dioxide combines with nutrient pollutants like fertilisers to drive kelp collapse. The nutrients act indirectly to promote weeds that out-compete kelp. Managing nutrients at a local level can address the effects of rising carbon levels. The European Union is highlighting this work.

Predicting changes in local biodiversity

Fish populations worldwide are suffering unprecedented stress. Through Australian Research Council Future Fellowship funding, our marine team undertakes wide-ranging studies into issues such as the mechanisms that control the biodiversity of coastal marine communities and how factors like ocean acidification and rising sea temperature affect them.

Examining the behaviour, physiology and competitive ability of selected fish species subjected to these stressors, will help to develop models that can more realistically predict changes in local biodiversity and the dynamics of marine populations.

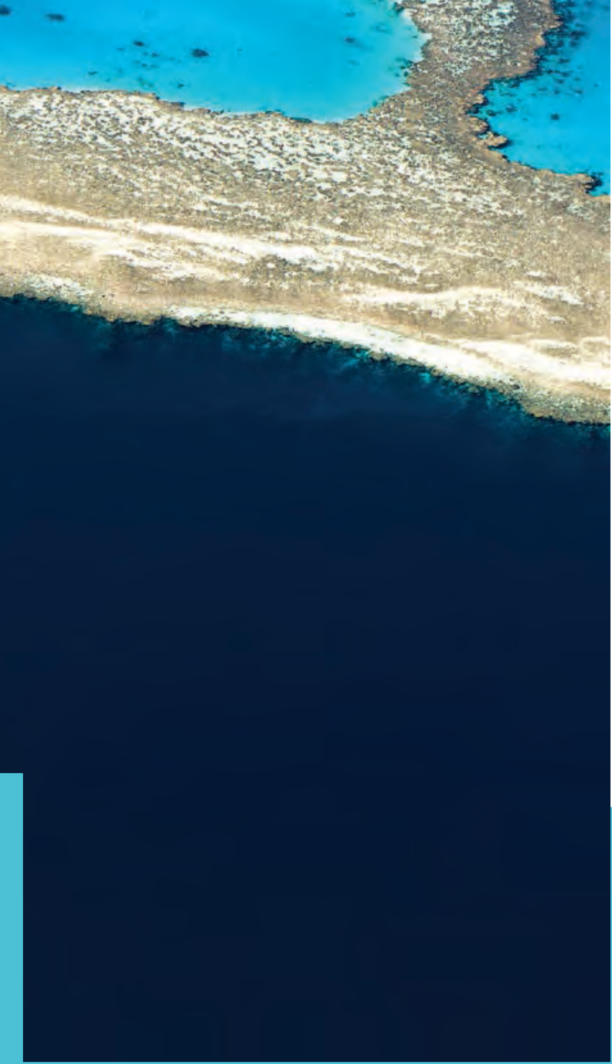
Study finds some reefs can be resistant

We were involved in research that found parts of Australia's coral reefs could be more resistant to ocean acidification than first thought.

Analysis of algal samples from Heron Island in Queensland discovered an extra mineral, dolomite, in coralline algae, which made the organism less susceptible to dissolving in increasingly acidic oceans.

As dolomite-rich coralline algae frameworks are common in shallow coral reefs globally, this study suggests they will probably continue to provide protection and stability for coral reefs as atmospheric carbon levels rise.

This work does not alter the importance of addressing climate change. Research like this allows us to prioritise effort into the most vulnerable environmental areas.



Fish ears give clues to climate change

Studying otoliths (fish ear bones) is providing important insight about how changes in temperature, climate or habitat can affect species and fish populations. Like a tree, large otoliths develop rings that contain valuable information about their environmental history.

Professor Bronwyn Gillanders' research group is measuring the width between growth rings in the ear bones of long-lived species like the Murray cod. Knowing how long a species will live and its maturity age will help to model fish growth, productivity and distribution in future environments to support sustainable fisheries management.

This approach may also help us to understand the impact of environmental changes like water salinity over a much longer time. For example, comparing the ear bones of fish from indigenous middens around the Coorong near the Murray Mouth with modern specimens may reveal whether species lived in more estuarine or freshwater environments than current habitats.

Spencer Gulf Ecosystem and Development Initiative

The Spencer Gulf is a rare reverse estuary located where the Indian, Southern and Pacific oceans meet. An area of high and unique biodiversity, the Gulf provides a nursery to a significant proportion of South Australia's fish species. The region is likely to undergo major economic development requiring careful management. Considering the impacts of a changing climate is also important.

We are leading a major marine investigation that brings together essential social, economic and biophysical information to understand the Gulf's environment and assess the growing pressures on it.

Our stakeholder engagement has already involved contacting more than 200 businesses and 500 individuals. The project has the support of major energy, mining, infrastructure, industry and fishing interests including BHP Billiton, Santos, One Steel, Flinders Ports, Centrex, the SA Department for Manufacturing, Innovation, Trade Resources and Energy, Flinders Power Partnership (Alinta) and the Fisheries Research and Development Corporation.

This initiative aims to enable credible, evidence-based assessment of development options that fully consider social and economic benefits while protecting and enhancing the health of the Spencer Gulf.

14 | SUSTAINING VIABLE LANDSCAPES

“The decisions we make today about what we do where on the landscape in terms of revegetation, how we practice agriculture, where we decide to maintain or increase cover or look after endangered species, will determine what the landscape looks like in 30, 40, 50 or 100 years.”

Professor Wayne Meyer

Changing growing conditions are challenging Australia’s capacity to protect our native species while producing food and running profitable farms.

The Institute investigates and improves understanding of future options for land use by considering both environmental and social systems. This research examines whole ecosystems as well as exploring management options to increase agricultural productivity while conserving and restoring natural resources.

Our research responds to the realisation that natural resource management (NRM) actions must happen at the landscape scale to solve problems like soil erosion, loss of soil structure, water quality, lower crop yields and biodiversity loss.

Demonstrating technical feasibility is a first step. A key focus of our work is to help develop the best ways for individuals, organisations and regions to access and apply this knowledge.

By supporting collaborative projects in landscape science, this research will help to ensure that Australia maintains viable landscapes well into the future by developing:

- new methods and models that better inform resource managers and policy makers of effective conservation, repair and maintenance options
- improved information systems to accurately assess and monitor the condition of natural resources and provide a basis for environmental projections
- skills and knowledge to plan, implement and monitor for improved natural resource management.

Regional responses

In South Australia, climate change is predicted to cause drier, warmer conditions, threatening the viability of current farming systems. Adapting to future growing conditions means working at both small (paddock) and large (regional) scales.

Landscape futures science is identifying opportunities to change land use for better economic returns and better environmental outcomes.

Precision agriculture and soil mapping will allow farmers to be more selective about how they use their land, particularly those areas that are unproductive for cropping. The result will be more varied and economically viable land use. For example, a region might include a mix of highly productive paddocks for crop and livestock production, areas with specific plantings to protect biodiversity, carbon plantings and connecting corridors of remnant vegetation.

Landscape futures

Work led by Professor Wayne Meyer is piloting a model to enable farmers, natural resource managers and those working to preserve our natural assets, to adapt to predicted climate change.

The model gathers and presents all the information about what makes up an NRM region, the condition of its resources and all the options to guide changing land use. This includes data about soils, water, vegetation, land use, infrastructure, regional demographics and economics.

Projects in the Eyre Peninsula and South Australia's Murray-Darling Basin regions are assessing the impacts of climate change to inform adaptation planning. The focus is on protecting biodiversity and farm productivity, and providing carbon biosequestration (capturing carbon using biological processes).

A new software tool will allow natural resource managers to pose 'what if' questions using regional information and climate change scenarios. Maps will illustrate how the landscape will look and function.

Once proven, this model can be widely applied across Australia. Access to adaptive planning and management strategies will help regional areas and communities to better prepare for climate change.

Tackling social challenges

We work with local government to tackle the considerable social impacts of climate change. What do we do about low-lying coastal developments with the sea rising at about 3 mm annually? How do we ensure that people remain happy and healthy and maintain local infrastructure when farmers are leaving the land and regional towns are shrinking?

A project co-led by Professor Wayne Meyer will support 11 local governments from the SA Murray-Darling Basin region to develop integrated water management and conservation plans, development policies, a tourism strategy and council strategic plans to respond to future climate change scenarios.

Preserving the unique qualities of the Mount Lofty Ranges

Our researchers helped to develop a proposal with four local councils to mount a bid to gain UNESCO World Heritage listing for the Mount Lofty Ranges agricultural region.

There are only eleven UNESCO World Heritage 'agricultural sites' in the world, none of which are in the Southern Hemisphere. Working agricultural sites are even fewer, for example, the Val d'Orcia region in southern Tuscany, Italy. The study found that the Adelaide Hills, Barossa Valley, Mount Barker and McLaren Vale regions have unique qualities that should be recognised and preserved for future generations.

The potential benefits of World Heritage listing are significant. They include economic growth through increased tourism, investment, and reputation premiums for local produce, improved environmental management, biodiversity protection and climate change adaption, and better agricultural production.

Stage one of the project involves developing a bid for National Heritage listing, and a concurrent bid by the federal government seeking World Heritage listing on behalf of all Australia.

Controlling exotic pests and diseases

The rapid globalisation of tourism and trade brings greater potential for the entry and spread of exotic pests and diseases into Australia. Human population growth, climate change, extreme weather events and habitat modification also act to spread animal pests, weeds and disease.

Biosecurity is vital to Australia's food security and food safety. It involves excluding, managing and eradicating unwanted pests and diseases. Plant pests, for example, can harm agriculture by reducing yields, lowering food quality, increasing production costs and restricting market access.

Associate Professor Phill Cassey and other Institute researchers are leaders in developing research that can deliver cost-effective ways to prioritise pathways through which dangerous foreign material or species may become threats within Australia. This includes using emerging technologies like DNA barcoding to screen specific risk sources. Being able to pinpoint the origin of a pest species enables us to identify how it spread or arrived, and find potential control measures in its exotic range.

16 | STRENGTHENING OUR RESPONSE

“From South Australia’s gulfs to the River Murray, from the arid interior to the state’s South East, through interstate collaborations, indigenous consultations, business and other organisations’ support we’ve seen a phenomenal growth in interest in our work. Research excellence and ability to frame our work so that it’s relevant, is at the heart of this development.”

Simon Divecha

There is significant evidence that our way of life, our society and economy, both in Australia and globally, are increasingly threatened by the impact of human activity on our environment.

Climate change, biodiversity and species threats are only a few examples. All link directly to the potential loss of services our environment provides. Such services include helping to produce clean air and water, pollinate and produce our food crop, regulate diseases and climate, support the processes essential for life, as well as cultural use and human enjoyment.

While many in our society recognise such services, people hold diverse opinions. These range from different priorities and foci on the importance of our environment, through to views that species have inherent rights and value.

Evidence and knowledge from the Institute underpin applying research to these 'wicked' problems we face today. Our engagement with these complex issues in turn shapes our enquiries and empirical scientific research.

Such challenges are central to the Institute's work. Examples of how we're transforming our ability to understand and respond to human and environmental problems are outlined throughout this report, on our website www.adelaide.edu.au/environment, and through numerous publications. Our public forums, extensive social media interactions and collaborative programs are central to generating some of the engagement needed to tackle these issues.

DNA research helps to tell the human story

Associate Professor Jeremy Austin's pioneering work in DNA sequencing is helping the Australian Army's Unrecovered War Casualties Unit to identify remains from the 'lost battlefield' at Eora Creek on the Kokoda Track.

This work forms part of his team's wider research that combines ancient DNA and forensic profiling techniques to identify the remains of the war dead, missing persons and disaster victims.

Our advanced DNA forensic capabilities include state-of-the-art sequencers and a clean room to minimise sample contamination. A key research focus is to understand human evolution through the recovery and analysis of minute DNA samples from ancient human bones and teeth. Like ancient DNA, many modern forensic samples are degraded and fragmented, putting their analysis beyond the capability of conventional DNA profiling laboratories.

By analysing DNA sequences, the research team can compare the person's DNA profile with family reference samples to search for a match.

Predicting biological threats

Exotic pests cost Australia more than $700 million each year but the impact on fragile native biodiversity is also devastating.

World-first modelling approaches developed by our researchers can counter this impact. Using mathematical principles, these 'meta-models' map the connections between ecological systems and represent the complex changes in species' populations and the way they interact with other species.

This provides sound information to apply proactive, cost-effective animal or pest management strategies that also benefit native flora and fauna. One example is the need to use less pesticide.

Professors Corey Bradshaw and Barry Brook combined basic environmental monitoring data and population density feedback models to predict the timing and scale of mosquito numbers in the Northern Territory. This allows public health and land use managers to use the most efficient control techniques to interrupt the breeding cycle and reduce the risk of disease outbreaks in humans.

This modelling has been used to help Singapore's government reduce numbers of the invasive Indian house crow to near extinction levels on the island, and to explore new options for schistosomiasis control in the People's Republic of China by managing the host snail population.

A practical tool for managing ecological threats, this approach also considers the social and economic aspects of these responses.

18 OUR LEADING MEMBERS

The Environment Institute brings together outstanding researchers working in an innovative, collaborative culture to focus on environmental research priorities of international significance.

Professor Alan Cooper

*Director, Australian Centre for Ancient DNA**

Australian Research Council Future Fellow

Professor Cooper specialises in using ancient DNA to record and study evolutionary processes in real time, particularly those associated with environmental change and human impacts. He uses information from areas such as geology, archaeology, microbiology, genomics and bioinformatics to provide novel views of evolution, population genetics and palaeoecology.

His current research features studies of early human evolution and dispersal, evolution of the human microbiome, megafaunal species and climate change, and the genomics and evolution of early domestic species and permafrost-preserved animals and plants from the Arctic and Antarctic. Prof. Cooper uses high throughput sequencing, bioinformatics and molecular clocks to reconstruct the nature and timing of past evolutionary events.

An Australian Research Council Future Fellow and Fellow of the Royal Society of South Australia, Prof. Cooper is an Associate Editor of *BMC Biology* and *BMC Evolutionary Biology*. He is a former ARC Federation Fellow, and built and subsequently directed the Ancient DNA Centre at Oxford University.

Professor Andy Austin

Deputy Director, Australian Centre for Evolutionary Biology and Biodiversity

Professor Austin's major research interests are in the biology, systematics and molecular phylogenetics of parasitic wasps, the evolution of host-parasitoid interactions, and the biodiversity and phylogeography of groundwater arthropods.

In conjunction with Ohio State University, he led a five-year, multi-national project funded by the US National Science Foundation to describe and name all 2500 species of tiny parasitic (*Platygastroidea*) wasps and to map their evolutionary relationships using DNA sequences and morphology. This work led to the discovery of new species and improved natural controls for economically important pests.

A comprehensive four-year survey of underground water, caves and micro-caverns across arid and semi-arid Australia, discovered previously unknown communities of invertebrate animals.

Prof. Austin is Editor-in-Chief of the international journal *Invertebrate Systematics* and is on the editorial boards of *Systematic Entomology* and *Insect Systematics & Evolution.*

He is also a senior research associate at the South Australian and Western Australian museums.

Professor Andy Lowe

*Director, Australian Centre for Evolutionary Biology and Biodiversity**

Professor Lowe's key research focus is in plant ecological and evolutionary genetics. His team are leading partners in coordinating large-scale ecosystem monitoring programs, such as the Terrestrial Ecosystem Research Network (TERN) and Transects for Environmental Decision Making (TREND) that track the course of biodiversity and ecosystems over time and space, and in response to environmental change.

He is a member of the Science Consultative Group of the International Barcode of Life initiative that aims to provide a system for rapidly and inexpensively identifying all life on Earth. Using knowledge of the genetic structure within species through DNA analysis, Prof. Lowe's work enables the development of specific genetic markers to discover new species and to support sustainable trade. Applications of this emerging technology include faster, more efficient environmental impact assessment, improved pest management and the capacity to track the source of timber products globally to halt illegal trade.

Prof. Lowe co-founded an international consortium to DNA barcode the world's grasses (GrassBoL), and is a member of TreeBoL - an initiative to genetically map Australia's trees.

Professor Barry Brook

Co-Director, Global Ecology Laboratory

*Director of Climate Science, Environment Institute**

Foundation Sir Hubert Wilkins Chair of Climate Change

Australian Research Council Future Fellow

Professor Brook holds the Sir Hubert Wilkins Chair of Climate Change at the School of Earth and Environmental Sciences. His research interests are climate change impacts, species extinctions, simulation and statistical modelling, energy systems analysis (with a focus on modelling future nuclear and large-scale renewable energy scenarios), and synergistic human impacts on the biosphere.

His work aims to determine the extent to which climate change amplifies other major human-induced threats to biodiversity (e.g. demographic and genetic stress, habitat degradation, introduced predator and competitor species). Prof. Brook is developing new modelling systems to enable this information to be used for prediction, adaptation and ecosystem management and restoration, and to forecast extinction risk.

An Australian Research Council Future Fellow, Prof. Brook runs a popular climate science blog - *Brave New Climate* - has authored three books, and is an International Award Committee member for the Global Energy Prize.

Professor Bob Hill

*Director, Environment Institute**

Professor Hill's botanical research has made significant contributions to the areas of palaeobotany, plant systematics, plant ecophysiology and applying research from these areas to interpreting changes that have occurred to Australian flora through evolutionary time.

During his career, he has won many awards including the Clarke and Burbidge Medals for his research into the impact of long-term climate change on the evolution of Australian vegetation. He is currently Editor-in-Chief of the *Australian Journal of Botany.*

Prof. Hill has been instrumental in raising the profile of modern botanical studies through his internationally recognised research, training numerous honours and postgraduate students, and through his distinguished service to botanical societies, organisations and government agencies.

His lifetime interest in the evolution of the vegetation of Australia and Antarctica has seen Prof. Hill widely published on this subject. He is best known for his research on the fossil history of the southern beech, *Nothofagus*, and the southern conifers.

Professor Bronwyn Gillanders

*Director, Marine Biology Program**

Australian Research Council Future Fellow

Professor Gillanders' research investigates the ecology of temperate coastal marine environments focusing on fish and cephalopods.

Her work studies connectivity between juvenile and adult habitats, patterns of fish movements, population structure and past ecological patterns, and environmental histories. She uses chemical tracers and growth increments in ancient through to modern fish ear bones to understand the impact of fishing pressure and changing environmental parameters on fish populations. A similar approach is giving insight into the life history of giant Australian cuttlefish in Spencer Gulf.

Prof. Gillanders leads the Spencer Gulf Ecosystem and Development Initiative, which aims to provide independent, credible information about the Gulf's unique ecosystem, current environmental pressures, and how to protect and enhance the region as major industry development occurs.

She is an Australian Research Council Future Fellow and immediate Past President of the Australian Society for Fish Biology. She co-authored the seminal volume in Australasian marine science, *Marine Ecology*, and sits on the editorial boards of several journals.

Professor Corey Bradshaw

Co-Director, Global Ecology Laboratory

*Director, Ecological Modelling, Environment Institute**

Australian Research Council Future Fellow

Professor Bradshaw has an international reputation in conservation biology and population ecology. His diverse research interests include population dynamics, predicting the vulnerability of species to environmental change and disease dynamics, to the environmental drivers of population change, including climate change biology.

His work focuses on analytical and computer simulation modelling, quantitative behavioural ecology, foraging dynamics, impacts of tropical habitat modification on biodiversity, wildlife population management and sustainable harvest, evaluation of the minimum viable population size concept, examining the relative contribution of intrinsic (density regulation) factors on population trajectories and the ecology of invasive species.

An Australian Research Council Future Fellow and Fellow of the Royal Society of South Australia, Prof. Bradshaw is the editor of *Ecology Letters* and *Frontiers in Ecology and the Environment,* and has a significant social media following through his blog *Conservation Bytes*.

Associate Professor Frank Grützner

Australian Research Council Fellow

Geneticist Dr Frank Grützner's general research interest is to understand how the genetic material of different species is organised in the cell and has changed over time.

His recent work has focused on the biology of monotremes, the platypus and echidna, the most distant living mammalian relatives of humans. This study examined the complex platypus sex chromosome system, isolating and analysing for the first time, the sequence of the male-specific Y-chromosomes and revealed that the platypus has 10 sex chromosomes compared to two in humans. This work is relevant to the evolution of Y-chromosomes in all mammals, providing valuable insights into the functions of human genes and the origins of human sex chromosomes.

State-of-the-art radio tracking and molecular genetic techniques used to study the platypus have been adapted to understand the behaviour and ecology of the echidna and the evolution of embryo growth regulation in other mammals.

An Australian Research Council Fellow, Dr Grützner's research also extends to understanding other animal systems such as reptiles and cattle.

Associate Professor Ivan Nagelkerken

Australian Research Council Future Fellow

Associate Professor Nagelkerken is a marine ecologist working in temperate and tropical coastal ecosystems and particularly fish, with a focus on ecosystem connectivity.

An Australian Research Council Future Fellow, he is studying the effects of climate change on fish and marine ecosystems with a focus on how ocean acidification and warming affect animal behaviour, species interactions, and community structuring. He also studies the nursery function of vegetated habitats for juvenile reef fish. Techniques such as tagging, telemetry, and stable isotope analysis of fish ear bones and tissues, track fish movement and dispersal to discover how ecosystem connectivity affects marine reserve functioning, the population dynamics of reef fish and the resilience of reefs.

Assoc. Prof. Nagelkerken's research will advance understanding of how climate change will affect the behaviour and physiology of fish species, how this could modify population dynamics and species community structuring, and the implications for the biodiversity, functioning and resilience of marine ecosystems.

Associate Professor Jeremy Austin

Deputy Director, Australian Centre for Ancient DNA

Australian Research Council Future Fellow

An evolutionary biologist, Associate Professor Austin specialises in extracting and characterising the trace amounts of highly damaged ancient DNA found in old human, animal and plant remains.

His research uses ancient and modern DNA to understand the impact of human activity over the last 200 years on threatened and endangered species, the impacts of climate change on genetic diversity and demography over the last 50 000 years, and the phylogeography of a range of vertebrates.

Assoc. Prof. Austin is investigating the impacts of the Victorian bushfires on native frog populations, the origin and impacts of devil facial tumour disease on Tasmanian devils, and the source and direction of human migration across the Pacific using modern and archaeological chicken DNA.

Through a four-year Australian Research Council Future Fellowship, he is applying his expertise in ancient DNA including environmental applications and the identification of human remains in missing persons' cases and disaster victim identification.

Associate Professor Justin Brookes

*Director, Water Research Centre**

Associate Professor Brookes' major research field is river and lake ecology and the quality of potable water sources with a focus on hydrodynamics, biology and water quality contaminants such as cyanobacteria and pathogens.

He leads several large collaborative projects examining degradation of chemical contaminants of concern (endocrine disruptors, pharmaceuticals), carbon cycling in lakes and rivers, and the ecology of the Coorong and Lower Lakes of the River Murray.

Assoc. Prof. Brookes is also leading a major research project on using biofiltration to treat reuse water. This work is particularly important in addressing major challenges in water management. These include environmental water efficiency, understanding how climate variability and land use affect catchment water quality, and maintaining vital water infrastructure.

He is a founding member of the management committee of the International Water Association Specialist Group on Lake and Reservoir Management and a member of the Steering Committee for the Global Lakes Ecological Observatory Network.

Professor Martin Kennedy

*Director, Sprigg Geobiology Centre**

Professor Kennedy's research focuses on geobiology - how the Earth's geological and biological systems interact to make our planet habitable. His approach combines detailed field observations with isotopic and mineralogical data from ancient and modern sediments to determine the changes in the Earth's biosphere through time, including the controls on the carbon cycle that regulate fossil fuel distribution and influence climate stability. Understanding the relationship between carbon levels and the evolution and stability of complex life provides vital insights on issues such as climate change.

Current research projects include studying how the destabilisation of methane deposits locked in permafrost, sea beds and arctic lakes may drive climate change, and what influenced the ancient carbon cycle and biogeochemical feedbacks in the biosphere to produce the conditions required for petroleum deposits.

Prof. Kennedy's work is important in understanding the connected geological and biological processes in sustainable energy in the form of geothermal resources, the significant opportunities and environmental implications related to transition energy sources such as shale and coal seam gas, and remediation of carbon and heavy metal pollution.

Professor Michelle Waycott

HBS Womersley Chair in Systematic Botany

Chief Botanist, State Herbarium of South Australia

Professor Waycott's research examines how plants and animals have adapted to survive in relatively extreme environments and the genetic, physiological and ecological implications of the strategies they adopt.

Her study of marine flowering plants, especially seagrass, includes population dynamics, genetics and evolution, molecular genetics, conservation genetics, biodiversity assessment and ecophysiological adaptations.

Prof. Waycott also has a strong interest in the human use of native plant species and is studying the variability and adaptation of a range of desert plants, including bush tomato and northern sandalwood, with a focus on their potential development as 'bush produce'.

She is the Chief Botanist at the State Herbarium of South Australia and is the HBS Womersley Chair in Systematic Botany at the University's School of Earth and Environmental Sciences.

Associate Professor Phill Cassey

Co-Director, Global Ecology Laboratory

Director, Biosecurity, Environment Institute

Australian Research Council Future Fellow

Associate Professor Cassey's research centres on human contributions to changes in biodiversity through the dual processes of species extinction and introduction.

This work uses exotic bird populations as a model to study the flexibility in behavioural and physiological traits during different stages of the invasion process and their impact on the host environment.

Assoc. Prof. Cassey is widely recognised for his work in the area of biosecurity. This includes developing DNA techniques to enable the identification of invasive species concealed in cargo, detection of pests and diseases through forensic environmental screening of specific risk sources, and tracking a pest species to its source to identify potential biosecurity issues in native ranges and ways to control its spread in its exotic range.

An Australian Research Council Future Fellow in Invasion Biogeography, Assoc. Prof. Cassey leads the Invasion Ecology Group, which aims to advance global change biology and particularly prioritising biosecurity risk assessment and management. He is also a member of the intergovernmental Vertebrate Pests Committee Incursions Working Group.

Professor Sean Connell

Australian Research Council Future Fellow

Professor Connell's research determines the extent to which local management can counter the ecological effects of climate change. The European Commission's Directorate-General for the Environment has recognised this work as offering a unique insight into the vital scientific issues relevant to current European Union environmental policy.

His work has a strong focus on developing investigative frameworks that incorporate local environmental studies in solving macro-ecological problems. For example, by recovering lost ecosystems, he pioneered an understanding of how pollution, past and present, combines with ocean acidification to drive future marine ecosystems. This work has contributed to changing policy that seeks to improve coastal water quality and water recycling on the land.

As an Australian Research Council Future Fellow, he authored the book *Marine Ecology* and works as an editor of several journals. He is active with *PLOS ONE*, which seeks to improve the recognition of scientific contributions by reducing over reliance on metrics that can sometimes result in a quite arbitrary measurement of the impact of research.

Professor Steve Cooper

Principal Research Scientist, South Australian Museum Evolutionary Biology Unit

Professor Cooper's expertise is in the fields of conservation genetics, molecular ecology, and phylogeography. His research focuses on investigating the diversity, evolution and molecular ecology of Australian fauna, predominantly subterranean and groundwater invertebrate fauna in the arid zone of Australia.

Prof. Cooper's work has included studying the molecular ecology and population genetics of mammals in the south east of South Australia and the conservation biology of yellow-bellied gliders.

Highlights of his research include an ongoing study of a new ecosystem of subterranean animals (beetles, crustaceans) in isolated calcrete aquifers of central Western Australia, and a long-term collaborative project investigating the biogeographic history and social evolution of Australian bees.

A principal researcher at the South Australian Museum, Prof. Cooper is also President of the Society of Australian Systematic Biologists and sits on the editorial advisory board of the *Australian Journal of Zoology.*

Professor Tom Wigley

Australian Research Council Discovery Outstanding Researcher Award

Professor Wigley's internationally recognised research examines how humans are changing and will change the global climate.

He has an honorary appointment, senior research associate at the US National Center for Atmospheric Research, and has published on diverse climatology topics. These include data analysis, climate impacts on agriculture and water resources, paleoclimatology and modelling climate, sea level and the carbon cycle.

He was made Fellow of the American Association for the Advancement of Science for his major contributions to climate and carbon cycle modelling and climate data analysis. Also a Fellow of the American Meteorological Society, Prof. Wigley has an Honorary Professorship with the University of East Anglia in England and an Adjunct Professorship with Curtin University in Perth.

Through Australian Research Council Discovery Project funding, Prof. Wigley's research tests how new climate models compare with observations, and is concerned with developing projections of how regional-scale climate will change and how these changes will affect ecosystems. His work also aims to improve conservation management through better forecasting of how biodiversity will respond to climate change.

Professor Wayne Meyer

*Director, Landscape Futures Program**

Professor Meyer is an irrigation, crop and resource management scientist with extensive experience in irrigated crop water use, evapotranspiration, soil-water balance measurement, crop system modelling and regional natural resource management.

With a focus on sustainable agriculture, he has led research in irrigation scheduling systems and developed experimental facilities for studying crop response at both the 'wet' and 'dry' end of the irrigation cycle.

Prof. Meyer has developed systems-wide research programs that explore the management options for improving agricultural productivity while conserving and restoring natural ecosystems. He instigated and guided the multiregional Lower Murray Landscape Futures project. This work analysed the effectiveness of existing regional natural resource management plans to identify options for improved agricultural and conservation systems that consider the possible effects of climate change.

The collaborative development of land use options to achieve renewable production and resource conservation is an ongoing research focus.

The Environment Institute's group membership comprises the:

- Australian Centre for Ancient DNA
- Australian Centre for Evolutionary Biology and Biodiversity
- Global Ecology Laboratory
- Landscape Futures Program
- Marine Biology Program
- Sprigg Geobiology Centre
- Water Research Centre

Our Management Team

Together with the research leaders detailed in the profiles with an '*', the following people also serve on the Management Team.

Professor Gus Nathan

Director, Centre for Energy Technology

Professor Mike Wilkinson

Head of the School of Agriculture, Food and Wine

Associate Professor Jenny Watling

Head of the School of Earth and Environmental Sciences

Simon Divecha

Business Manager, Environment Institute

23 CONNECTING RESEARCH AND THE COMMUNITY

"Currently more than 80 per cent of humans' energy comes from burning fossil fuels and we would have to replace all of that within the next 50-odd years if we are going to mitigate the serious problems we are facing now."

Professor Barry Brook

As a society, we can only make informed decisions when we have access to relevant, robust scientific research.

This makes communicating the work of our scientists beyond the realms of publications and journals ever more important, particularly if we want people to engage with environmental systems.

We connect our research to society through numerous channels and events, using a mix of traditional and digital media.

The Environment Institute was an early adopter of online platforms and our strong online presence continues to grow. In addition to our established blog, Twitter, Facebook, YouTube and LinkedIn networks, we have included Google+, one of the world's fastest growing social media platforms during 2012. Content distributed through our integrated online network reaches more than 3000 people directly, amplifying to an audience of tens of thousands globally.

The extensive reach of the Institute's blog network had doubled by the end of 2012. Professor Andy Lowe launched *Biodiversity Revolution*, Dr Bayden Russell - *Active Oceans*, and Dr Seth Westra - *The HydroFiles*. These joined Professor Barry Brook's *Brave New Climate*, Professor Corey Bradshaw's *Conservation Bytes* and Simon Divecha's *Sustainability Developments*.

Since 2008, *Brave New Climate* has continued to attract significant traffic with more than 3.5 million hits, while *Conservation Bytes* has had over 800 000 hits.

The redesign of our website better integrated our existing online platforms. Now more current and dynamic, the site has attracted 61 808 page views and 44 930 unique visitors over the past year.

Launching the Sprigg Geobiology Centre

November 8 saw the launch of the Environment Institute's newest centre, the Sprigg Geobiology Centre. Named in honour of pioneering South Australian geologist, explorer and environmentalist, Reg Sprigg AO (1919-1994), it brings together an interdisciplinary research group unique in Australia.

The Centre studies the biological and geological processes that together control the habitability of our planet. Marg Sprigg, Reg's daughter, launched it and we are honoured and delighted that the Sprigg family granted naming rights.

Geobiology encompasses the fundamental science of how organisms both alter and evolve in response to the environment and how they control geologic processes that influence resource distribution and environmental stability. Geobiological research thus addresses critical questions facing society. These include sustainable energy and resources, changing climate, resource scarcity, environmental dispersion of toxins and species diversity.

International impact

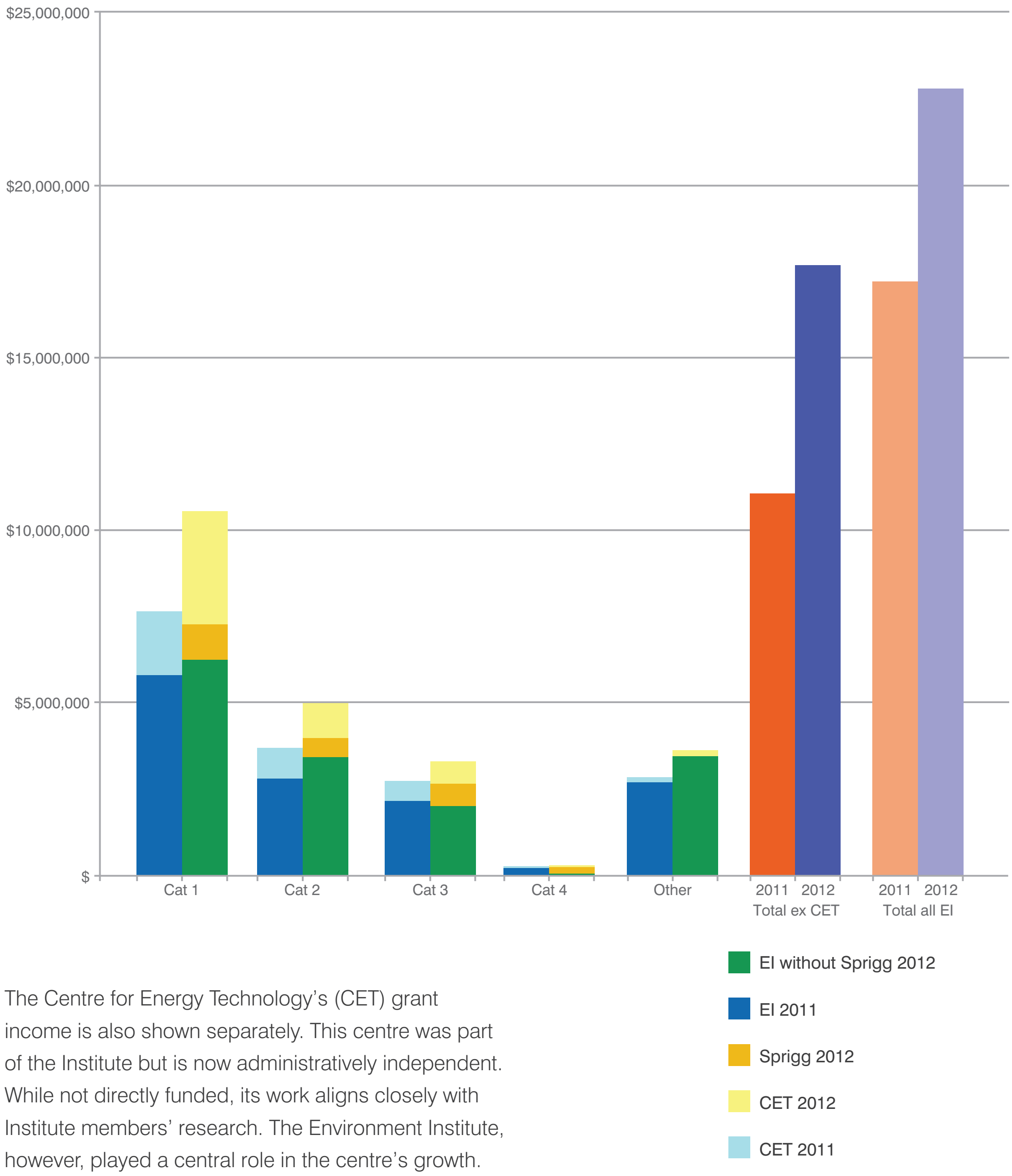
The impact of our research resonates around the world. For example, articles about a wasp that eats a spider featured in the *New York Times*, *The Huffington Post* and on the Discovery Channel.

A West Australian family's keen observation of a wasp killing and eating a redback spider led Professor Andy Austin and his team to rediscover a native wasp (*Agenioideus nigricornis*). Despite being first described in 1775, the wasp had been lost to science for more than 200 years. Now, further studies are being conducted on the wasp to learn more about its potential to control redback spider populations and if it could be used overseas to prevent further infestations in countries like Japan, New Zealand and India.

24 DELIVERING ON OUR OBJECTIVES

Grant income across the Environment Institute grew strongly between 2011 and 2012.

The chart below shows active grant income during each year. The chart is divided to show income for the Institute's membership and the change once the Sprigg Geobiology Centre joined us upon its launch in 2012.



The Centre for Energy Technology's (CET) grant income is also shown separately. This centre was part of the Institute but is now administratively independent. While not directly funded, its work aligns closely with Institute members' research. The Environment Institute, however, played a central role in the centre's growth. Sponsorship, such as through the Adelaide Airport, funds core activities. CET members also take part in the Institute's work and the centre's Director, Professor Gus Nathan, serves on our management team. Categories refer to funding as reported for Higher Education Research Data Collection

25 PUBLICATIONS

A full list of publications by the Environment Institute's 18 leading researchers profiled in the previous pages follows. In 2012, 488 journal articles were published across the whole Institute. To view this extensive list, please visit: www.adelaide.edu.au/environment/news

Journal Articles

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