ARI

Australian Rivers Institute

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Griffith UNIVERSITY
Queensland, Australia

CONTENTS

DIRECTOR'S PERSPECTIVE

From the ARI Director, Professor Stuart Bunn

Challenges to water security and the sustainability of aquatic systems can only be met if there is effective communication between scientists, decision makers and the broader community.

At the Australian Rivers Institute (ARI) our researchers are involved in innovative, world-class science focused on improving understanding of catchment, river, estuarine and coastal ecosystems. We are committed to ensuring our work has real impact and makes a real difference in protecting our environment.

In this, the first edition of the ARI magazine, we showcase some of our current work, our researchers and the partnerships that have helped make us a field leader.

Research partnerships that demand both innovation and application have inspired some of our most significant science. Our longstanding collaboration with Seqwater continues, helping them provide safe drinking water to more than three million people in Queensland's south-east. This research has helped identify catchment sources of sediment and nutrients that affect water quality and the cost of treatment, and to minimise the risk of algal blooms.

Informing policy is at the heart of Dr Adame's research (page 6). Fernanda has challenged the guidelines used to inform international climate policy and found the carbon in mangrove ecosystems is vastly undervalued in the Paris Climate Agreement.

Dr Kylie Pitt is also beginning a unique collaboration with Sea World to produce the Sea Jellies Illuminated exhibit (page 5). It will be the world's largest operating jellyfish laboratory on display to the public. This facility will play a key role in Sea World's education program and support the Institute's research on coastal ecosystems.

We continue to directly engage with regional and national water management issues and our researchers are involved in key advisory roles informing policy and practice. These include membership of the science advisory committees for the Lake Eyre Basin and SEQ's Healthy Land and Water, and my recent appointment to the Murray-Darling Basin Authority.

This year we have strengthened our partnership with the International Water Centre, which provides professional training and teaching for local and international scholars.

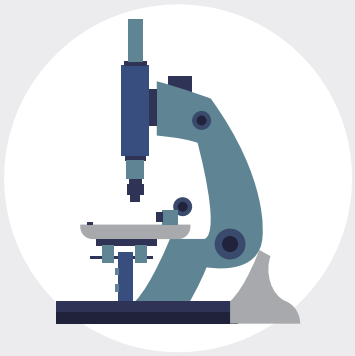
The Centre has been relocated to Griffith University and is a valuable resource for researchers and students. The University is also hosting and providing support to the secretariat of the Sustainable Water Future Programme. These initiatives provide unique opportunities for our researchers to connect and collaborate with water practitioners from across the globe and learn more about international water issues.

These partnerships demand our researchers be not only world-leading scientists but also articulate science communicators. We recognise there is a compelling need to more effectively communicate the cause and consequences of threats to our freshwater and coastal ecosystems—and potential solutions—to the broader community. Science communication has always been an important part of ARI's DNA.

We are launching this magazine as recognition of those efforts and believe it will be a starting point for many new conversations.

'...we also strive to ensure our work has impact and makes a difference.'

SCIENCE COMMUNICATION HAS MANY BENEFITS



Helping the public understand the importance of scientific research and how it helps shape government policy

Helping policy creators make scientifically informed decisions

Helping the public understand how science can positively impact their lives

Helping governments understand the positive impact scientific research can have on the environment, resource management, the economy, health and social welfare sectors

WHAT'S HAPPENING

Strengthening ties: Dr Ryan Burrows selected for EU-Australia forum

ARI Research Fellow Dr Ryan Burrows has been selected to participate in the 2018 EU-Australia Leadership Forum, to be held in Brussels this November.

Dr Burrows brings his expertise in ecohydrological processes and the impacts of human activity and climate change in Europe and Australia. He will focus on the sustainable use of groundwater and the complex environmental impacts arising from interactions between climate change and economic development.

The forum aims to forge strong ties between the EU and Australia and advance the proposal of an EU-Australia Free Trade Agreement. It brings together some of Australia's and the EU's key leaders and policy makers, providing input and ideas to diversify diplomatic, economic, social and research ties.

Undoubtedly, Dr Burrows will be great ambassador for Australia, Griffith University and ARI.

18 years strong: Seqwater partnership continues

ARI is pleased to announce our ongoing partnership with Seqwater will continue for another three years, totaling 18 years of collaboration.

This partnership has provided some outstanding opportunities and outcomes. Our joint research has informed catchment management actions to reduce nutrient inputs to dams, determined the effect of water level variations on aquatic plants in dams, and identified which types of algae pose the highest risks to human and ecosystem health.

Seqwater provides quality water for more than three million people across the region, delivered via a supply infrastructure worth $12 billion. The importance of managing the water supply and understanding environmental stressors affecting water quality and quantity is key to delivering sustainable safe drinkable water to the entire South-East Queensland region.

The new agreement will facilitate coordination of ARI experts and Seqwater research needs. It aims to produce research that identifies water quality risks and successfully develops management and mitigation strategies to control them.

These risks include—but are not limited to—climate change, land use change, floods, droughts, microbiological factors, sediment and nutrient release and organic, heavy metal and chemical incidents.

ARI will also provide research support in forecasting changes in water supply catchments and evaluating effects on water quality and supply. We look forward to working with Seqwater to improve water management across South-East Queensland.

KEY PARTNERSHIP SUCCESSES:

- Discovering Cyanobacteria blooms previously thought to be due to a single species arise from any of at least 20 genetically identifiable strains.
- Determining some organic materials leaching from plants (e.g., eucalypts and tea tree) either enhance or hinder growth of different algae, helping identify species of tree suitable for revegetation of water supply catchments.
- Quantifying the effect of water level variations on aquatic plants in dams.
- Developing greater understanding of water taste and odour, improving social perception of water quality and aiding Seqwater's reputation as water provider.
- Improving water testing methods to reduce costs through lowering water testing frequency.
- Aided in calculating greenhouse gas emissions from Seqwater's natural and built assets and calculated carbon storage rates of catchment vegetation.

The International Water Centre finds a new home at Griffith University

The International Water Centre (IWC) has relocated to Griffith University's Nathan Campus, bringing unique opportunities for students of both the IWC and ARI.

This move brings together some of the world's leading water researchers and experts and has also strengthened Griffith's role as a key participant in the Sustainable Water Future Programme.

The IWC performs a critical role in developing relationships between Australian water experts and the international water sector, offering professional education and training, capacity development and applied research services which promote greater water sustainability approaches to policy development, management and planning.

Through education and training programs the IWC has helped develop more than 1000 water professionals from more than 75 countries. New students of the IWC will now gain access to Griffith University's teaching staff and exceptional research facilities.

Like ARI, the IWC has a clear focus on developing comprehensive water management programs and providing internationally recognised researchers and teachers. Their relocation is a fantastic outcome for Griffith University and ARI.

RESEARCH IN FOCUS

ARI and Sea World:
Shining a light on mysterious lives of jellyfish

They come in all shapes and sizes. They are mysterious and potentially deadly, with long-trailing tentacles and blobs for bodies. And now, thanks to a new partnership between Griffith University and Sea Word, the mysterious lives of jellyfish will be on public display.

An innovative new exhibition *Sea Jellies Illuminated*, launching at Sea World later this year, represents a unique collaboration. As part of the exhibit, Griffith University researchers and students will manage a world-class jellyfish laboratory. It will give unprecedented and innovative exposure to research in action, both educating and raising public awareness.

The facility will be the most comprehensive laboratory in the world dedicated to jellyfish and includes a number of large Kreisel (spinning) tanks, which have access to running sea water. They will showcase several unique species of jellyfish and offer interactive informational screens for guests.

The new laboratory will expand the research capabilities of Griffith University researchers and students, allowing for unique and focused jellyfish research. The custom-built facility will allow for well-replicated experiments to be conducted on a variety of environmental issues.

Like Griffith University, Sea World is committed to conserving our marine environments. It has a strong conservation initiative developed under the Sea World Research and Rescue Foundation. The foundation offers funding grants to researchers and strategic assistance in the field and supports whale rescue operations.

Research spotlight:
Does climate change cause jellyfish blooms?

Sea Jellies Illuminated will provide ARI's Associate Professor Kylie Pitt with a unique opportunity to analyse environmental stressors that directly affect jellyfish across their lifecycle.

The facility will allow Griffith researchers to raise jellyfish through their complex life cycles, thereby enabling studies to be conducted against different moments in the jellyfish life.

This will include controlled environmental stressor experiments against different generations of jellyfish, allowing for greater understanding of the human impact on jellyfish.

Of note, experiments can be conducted on the ability of jellyfish to adapt to climate change, vital for Dr Pitt's research on jellyfish blooms.

Jellyfish blooms can cause major disruption to human use of the ocean, delaying trade by getting caught in ship engines and damaging water intake systems on coastal power stations. These blooms have been blamed on water pollution, sediment runoff and global warming. Dr Pitt believes that, although there are some robust species that are increasing in population size, there are more vulnerable species that are dying out.

The laboratory will help her investigate various factors and help ensure the future of jellyfish populations is managed and protected.

Highlights:

- *Sea Jellies Illuminated* will be the most comprehensive laboratory in the world dedicated to jellyfish
- It will give researchers the ability to perform controlled environmental stressor experiments against different generations of jellyfish
- The lab will give unprecedented and innovative exposure to research in action

Reference: Sanz-Martin, M., Pitt, K., Condon, R. H., Lucas, C. H., Santana, C. N. de, & Duarte, C. M. (2016). Flawed citation practices facilitate the unsubstantiated perception of a global trend toward increased jellyfish blooms. *Global Ecology and Biogeography*, 25(9), 1039–1049.

ARI RESEARCH HIGHLIGHTS

Mangroves a weapon in fight against climate change

Mangroves have been significantly undervalued in their ability to store large amounts of carbon in their soil through a process termed sequestration, research by ARI's Dr Adame has found.

Dr Adame, in partnership with WILDCOAST's blue carbon conservation project group, has been studying the marine plants in the Gulf of California, with potentially significant impacts for the carbon trading market and future mangrove conservation projects.

Her research shows emissions from the deforestation and degradation of mangrove ecosystems in Mexico is 31 times greater than the values used to determine the national emission reduction targets for the Paris Climate Change Agreement (PCCA).

'This research demonstrates that if mangrove ecosystems in Mexico are protected they could prevent the emission of over 32.8 million tons of CO_2 by 2030.'

What are carbon credits?

A carbon credit is a permit or certificate allowing the holder to emit carbon dioxide or other greenhouse gases. The credit limits the emission to a mass equal to one tonne of carbon dioxide. The issue of carbon credits aims to reduce the emission of greenhouse gases into the atmosphere.

The issue relates to the classification methods of the mangroves. Under the PCCA mangroves were classed as terrestrial forests, which fails to account for the large amounts of carbon stored in the soil by mangroves.

Dr Adame' s research has demonstrated that if mangrove ecosystems in Mexico are protected they could prevent the emission of over 32.8 million tonnes of CO_2 between now and 2030. Mangroves make up only 1.2% of all forested areas in Mexico, but the research uncovers the true value of the mangroves, showing the entire country's emissions could be reduced by six to 10% by 2030 if the areas became conservation districts. This research highlights the acute need for mangrove conservation and their vital role in offsetting carbon emissions if introduced into a carbon market trading scheme.

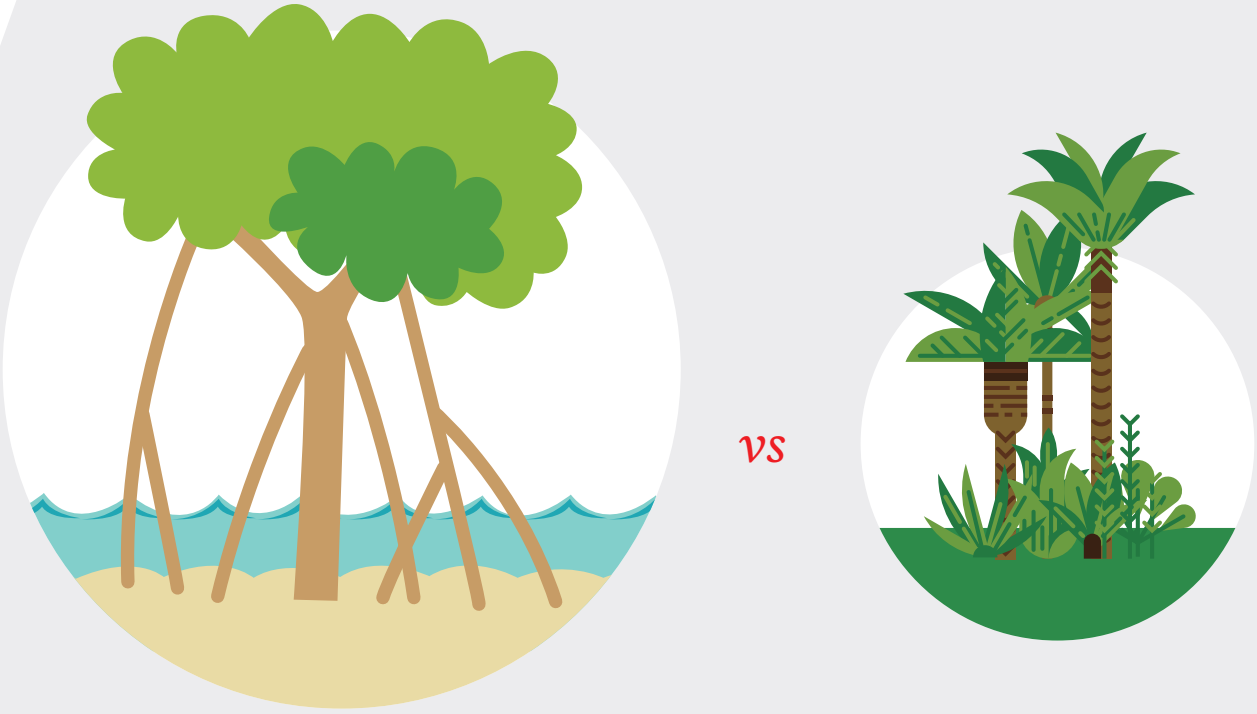
The WILDCOAST Blue Carbon Project, with the help of Dr Adame, aims to preserve more than 30,000 hectares of mangroves in the Gulf of California. The team hopes to gain carbon accreditation of the mangrove ecosystems lining the Gulf's coastlines and help facilitate the selling of the accredited carbon credits on the carbon market to fund the mangroves' protection. If successful, the project will be one of the first examples of large-scale blue carbon ecosystem conservation.

Project Partners: WILDCOAST's blue carbon conservation project is a collaboration between: WILDCOAST; Mexico's Ministry for the Environment (SEMARNAT); Mexico's National Commission for Protected Areas (CONANP); The DiCaprio Foundation; Dr Adame's research was funded by a scholarship from The DiCaprio Foundation.

Reference: Adame MF, Brown CJ, Bejarano M, Herrera-Silveira JA, Ezcurra P, Kauffman JB, Birdsey R. The undervalued contribution of mangrove protection in Mexico to carbon emission targets. *Conservation Letters.* 2018:e12445. https://doi.org/10.1111/conl.12445

'The WILDCOAST Blue Carbon Project, with the help of Dr Adame, aims to preserve more than 30,000 hectares of mangroves in the Gulf of California.'

The importance of mangrove conservation



vs

Dr Adame predicts if one hectare of mangrove forest is deforested it can emit betweem 3 and 10 times the amount of carbon as one hectare of deforested terrestrial forest.

Can planting trees help save fish from climate change?

Revegetating riparian zones to provide shade over river edges virtually negates temperature rises caused by climate change that impact the blackfish, an ARI researcher has found.

Climate change is a significant threat to major ecosystems globally but ARI Research Fellow Mischa Turschwell has just revealed a localised solution to help limit the temperature effects of climate change on fragile river ecosystems and specifically the northern river blackfish (*Gadopsis marmoratus*). Clearing of riparian land in agricultural areas has left rivers exposed to direct sunlight leading to a rise in river temperatures. This change has had devastating effects on river ecosystems, which can be highly sensitive to sudden or ongoing environmental stressors. Vitally, it means some species struggle to survive in ecosystems they once thrived in. This is of significant concern as the removal of one species from an area can impact the overall health and balance of the ecosystem.

Turschwell and his team analysed previous research on the blackfish—a threatened species in the upper Condamine River—to test how climate change and restoring the riparian zone by planting trees might affect survival rate. The research indicated if mitigation strategies were carried out to restore and revegetate riparian zones, the effects of climate change on rivers could almost be completely offset. Furthermore, species like the blackfish that are highly sensitive to environmental change would have greater chance of thriving. The benefits of restoring the riparian zone did not end there. It also aids in reducing erosion and sediment run off and contributes to improved overall water quality The significance of this research is in the data's ability to help inform river management programs to protect species like the blackfish.

This research indicates the significant need for liaison between catchment managers and farmers, who use riparian zones for grazing of cattle and sheep. A mitigation strategy implementing fencing and active restoration of the riparian zone could conflict with farming practices and have significant social and economic costs. However, the long-term effects of such a mitigation strategy has a significant ecological value that cannot be ignored.

'The research indicated if mitigation strategies were carried out to restore and revegetate riparian zones the effects of climate change on river temperature could almost be completely offset.'

Reference: Turschwell MP, Stewart-Koster B, Leigh C, Peterson EE, Sheldon F & Balcombe SR (2017). Riparian restoration offsets predicted population consequences of climate warming in a threatened headwater fish. Aquatic Conservation: *Marine and Freshwater Ecosystems* Volume 28, Issue 3, pg 575-586. https://doi.org/10.1002/aqc.2864

Poor water quality means poor reef quality

ARI's Dr Chris Brown has been investigating the effects of human produced poor water quality on reefs in the Solomon Islands, where a history of logging has had significant effects on local reef ecosystems.

The impact of poor water quality and the damage it can cause to specific reef organisms is well documented. However, the impact of pollution diffusion on the entire reef ecosystem remains relatively unknown.

In previous decades, the rich rainforests of the Solomon Islands were logged leading to rich topsoil sediment flooding into the ocean. This has had significant impact on the water quality of many areas, negatively affecting reefs and fish nurseries that struggle to survive in murkier waters. The impact on the reefs is not only an environmental issue but a social and economic issue for the region as well—locals depend heavily on the reefs for food and tourism.

Through his research, Dr Brown has developed a model that can be used more generally to estimate the footprint of human impact on ecosystems and evaluate the benefits of conservation actions in varying ecosystems. By analysing changes in the types of reef habitats on the ocean floor, Dr Brown was able to map the impacts of pollution. Mapping assessments of reefs can now inform managers about the impacts of new developments and help bolster efforts to avoid further human impact.

Dr Brown studied the effects of poor water quality caused by logging on several different reefs, which varied in distance from logging zones. He found branching corals appeared more common in clearer water located further away from logging activities. The reefs closer to the logging zones existed in significantly murkier waters and were found to have an increased level of sand, dead coral and stress-tolerant brain corals. Furthermore, areas closer to logging had poorer water quality and showed lower levels of biodiversity, whereas areas with clearer waters displayed higher levels of biodiversity and included species sensitive to change and pollution. This information allowed Dr Brown to develop a new statistical method/model that utilizes the diversity of the habitats as an indicator for the impact of pollution on the reefs.

Ecologists often determine the overall health of an ecosystem by measuring the diversity that is present in that habitat. Commonly they will measure two types of diversity. The first is alpha diversity, the number of habitat types at one site. The second is beta diversity, the measurement of change in the types of habitats as you move between differing areas.

By comparing the sites, Dr Brown was able to measure the sites' beta diversity, illustrating how the impacts of pollution dissipate in coastal sea water. This measurement allowed for the determination of how far coral reefs had to be from pollution to avoid being impacted.

It was estimated close to 50% of reefs in the Kia region of the Solomon Islands had potentially been affected by pollution caused by logging on land.

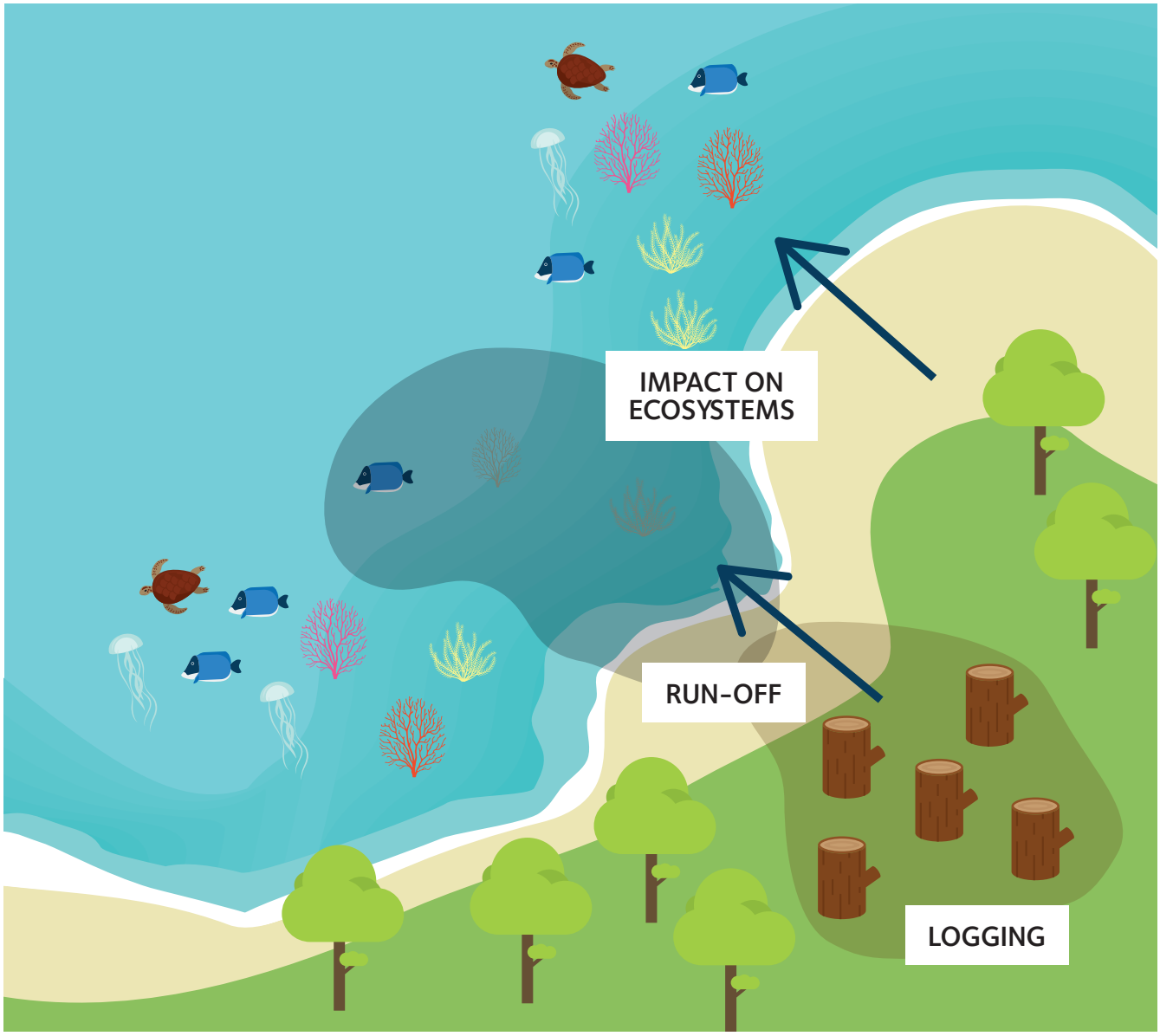
Dr Brown's model can now be used more generally by ecologists to estimate the impact of pollution and human activity on ecosystems and evaluate the benefits of conservation actions in varying ecosystems. This is an important area of research in Australia, with growing concern for the health of the Great Barrier Reef, which can be monitored using this model. The research also helped the adoption of better management programs run by The Nature Conservancy, who work with local communities protecting remaining forests in the Kia region.

Project Partners: Dr Brown produced this research through a collaboration with Dr Hamilton of the Nature Conservancy.

Reference: Brown CJ, Hamilton RJ. Estimating the footprint of pollution on coral reefs with models of species turnover. *Conservation Biology*. 2018 Jan 15

Highlights:

- ARI's Dr Chris Brown has been investigating the effects of poor water quality on reefs in the Solomon Islands, where there is a history of logging.
- Dr Brown has developed a model to estimate the footprint of human impact on ecosystems and evaluate the benefits of conservation actions.
- It was estimated close to 50% of reefs in the Kia region of the Solomon Islands had potentially been affected by pollution caused by logging on land.



How poor water quality changes reef ecosystems

'By analysing changes in the types of reef habitats on the ocean floor, Dr Brown was able to map the impacts of pollution.'

OPINION, PEOPLE AND PERSPECTIVE

Returning to Australia: A moment of reflection

Professor David Hamilton, Deputy Director, ARI

After 15 years—during which time there was a millennial drought as well as a few floods—I have returned to Australia as Deputy Director of the Australian Rivers Institute.

I was based at the Centre for Water Research (CWR) at the University of Western Australia for 12 years from 1991 to 2002, and then at the University of Waikato in New Zealand for 15 years, from 2002 to 2017.

Coming back to Australia provides an opportunity to reflect on some of the events and changes over the past 15 years. Not long before I came to ARI, CWR was disbanded by the University of Western Australia. CWR was a world leader in physical limnology—the transport and mixing of inland waters. The legacy of CWR lives on, entrenched in many of the aquatic models we currently use and in the scientists from CWR who are dispersed around the world.

Without CWR there has been a serious loss of intellectual leadership to drive new research findings being embedded into aquatic models. The importance of these models is evident in recent funding allocated from the state government to support the Queensland Water Modelling Network. I believe we need to address the gap left by CWR in order to bring about more active reconfiguration of aquatic models to reflect new research findings from ARI, Australia and around the world.

It is interesting to reflect on the extent to which funding is 'event-driven'. I seem to have a habit of being close to some of these events. For example, in 2000 there was a major cyanobacteria (blue-green algae) bloom in the Swan River in Western Australia following a rare summer storm. The Swan River was a no-go zone for a couple of weeks until flow subsided and the bloom dissipated. This event focused management attention on the sustainability of the Swan River and more widely on estuaries in south-west Western Australia. The threats and problems for these estuaries continue to escalate through time.

After arriving in New Zealand in 2002 I was shocked at the rapid expansion of the dairy industry and its potential for impacts on waterways, as mitigation measures were minimal and algal blooms were reported to be expanding. I put forward the idea of a moratorium on dairy expansions to 'put limits in place first before these very big investments in dairy infrastructure and irrigation take place'. The response has been varied: a nitrogen trading scheme (with a cap for the catchment) has been implemented for

Lake Taupo but only after 10 years when each policy step has been contested. For Lake Rotorua a final nutrient management policy is still not in place because of many years of challenges at each step of implementation. The elephant in the room—limiting the total number of dairy cows—is unlikely to be part of the policy, as complicated modelling assessments of nutrient losses from farms are used to guide limits, caps and trading of nutrients as part of future policy implementation.

The reason I mention the New Zealand situation is because of recent publicity regarding the protection of the Great Barrier Reef and coastal waters of south-east Queensland. The focus has been on sediment , particularly in light of post-2010 floods, but attention is likely to shift to nitrogen in the near future. I expect similar arguments to play out here to those in New Zealand: the potential impact on the economy of nutrient management policies, the validity of models used to assess nitrogen loads and how long should be allowed for implementation of mitigation measures.

Key insights and lessons learned:

- water quality problems don't go away overnight and a more concerted effort is required between periods of crisis
- models are increasingly being used to guide policy and these models need to be robust, fit-for-purpose and accurate
- environmental policies that are perceived to impact income from the productive sector are exceedingly hard to implement
- many farmers would also like to have certainty about their new operating environment, with time to adjust

LIFE AS A SCIENTIST

Dr Stephen (Harry) Balcombe is one of ARI's longest active members, known for his quick wit and enlightening discussions.

Life as a scientist is pretty fun but you still have homework...

I've often been questioned about how cruisy it must be to work as a research scientist investigating natural resource management. The premise is that you can spend lots of time going fishing, looking at trees and driving around the country. Well, yes, the highlight for me is exactly that, going out to weird and wonderful places, observing and measuring nature, and interacting with landholders in various landscapes. But, there is really nothing that can beat the sheer wonder of finding something unexpected in the murky depths of a turbid waterhole, such as a newly-hatched catfish in an odd location, a mass flowering event of a common tree like mulga that you have never witnessed before, even having been around them for over 20 years in multiple locations.

Of course, running around in these awe-inspiring places has its downside—there are data to be entered, reports to write and similarly rewarding peer-reviewed publications that arise. This requires a trade-off between the freedoms of the field with sitting for long periods at a desk—it is clear which wins.

New projects on the horizon

I am currently working on two federal government funded projects that take me out into the drylands of southern Qld and northern NSW, deep in the heart of cotton and cattle country. The first involves sampling waterholes in the lower Balonne River catchment to investigate the hydrological and ecological cues for successful fish spawning as evidenced by the presence of fish larvae. Once caught, the project then examines what the larvae are feeding on and how this changes through time and how it relates to the available prey in the system. Ultimately, this project hopes to use this knowledge to provide some guidance for environmental flow releases to best provide for native fish recruitment. The second project is focused on terrestrial landscape vegetation and examines the multitude of benefits provided by natural areas on cotton farms, such as biodiversity, pollination, natural pest management and social amenity. The fun part for me in this project is going out to cotton farms, talking to landowners and measuring the huge array of plant species in these natural areas.

'But, there is really nothing that can beat the sheer wonder of finding something unexpected in the murky depths of a turbid waterhole, such as a newly-hatched catfish in an odd location, a mass flowering event of a common tree like mulga that you have never witnessed before.'

PEOPLE AND PROJECTS

New staff:

It is a pleasure to introduce some of our new colleagues, who bring with them a variety of amazing skills to help ARI expand its expertise base.

Dr Chantal Lanctot

One of our exciting additions is actually a familiar face. Dr Chantal Lanctot returns to ARI as a Australian Research Council (ARC) Discovery Early Career Researcher Award (DECRA) Fellow.

Chantal's research interests include understanding how pollutants negatively impact aquatic wildlife, with a particular emphasis on developmental and physiological effects in larval frogs.

Her DECRA project, *Metal toxicokinetics and toxicodynamics in developing anurans: how metamorphosis influences metal burdens*, will be the first to explore how the mobilisation and transference of metal burdens during metamorphosis influences toxicity in amphibians.

By applying high-resolution analytical and imaging technologies, including X-ray fluorescence microscopy at the Australian Synchrotron, Chantal aims to unravel this interesting phenomenon to improve our knowledge of how complex life cycles influence the vulnerability of wildlife to toxic metal burdens.

Before starting her DECRA Dr Lanctot worked at the International Atomic Energy Agency (IAEA) in Monaco for six months, where she used nuclear tools to study the effects of microplastics and associated chemical contaminants on marine organisms.

She completed her PhD at Central Queensland University (2016) on the toxicity of coal mine wastewater to freshwater organisms.

Prior to moving to Australia, Chantal received her Masters from the University of Ottawa in Canada, where she studied endocrine disrupting effects of glyphosate-based herbicides in tadpoles.

Dr Christopher Ndehedehe

Dr Christopher Ndehedehe brings expertise in remote sensing, ecohydrology and environmental geoinformatics to ARI.

He is one of the pioneering researchers in the emerging field of environmental geoinformatics, having studied the terrestrial hydrology of Sub-Sahara Africa and the impacts of climate variability on its water resources.

His research focus is on bridging the gap between science and policy through the applications of a wide array of geospatial tools. Dr Ndehedehe analyses vast and complex remotely sensed earth observations in ways that improve our understanding of eco-hydrological processes and the impacts of climate variability on changes in freshwater resources.

He has received a Commendation from Curtin University Chancellor for an Exceptional Higher Degree by Research. He was also awarded the 2018 D. B. Johnston Award for Excellence in recognition of excellence in postgraduate studies in the Spatial Sciences area at Curtin University.

Dr Melanie Roberts

Working at the intersection of data and mathematical modelling, Dr Roberts has experience with developing and implementing decision tools across emergency management, agriculture, water management and insurance.

Her recent work involved developing models to understand household-based risk from bushfires to assist communities in reducing their risk while maintaining the benefits of living in a bushland environment.

At ARI, Dr Roberts will draw on her experience in applied and industrial mathematics to investigate how changes in land use management will help improve the health of the Great Barrier Reef. Her work will initially focus on developing novel models in the riverine environment to understand the contributions of gullies to sediment loads.

She is also the returning officer for the Australia and New Zealand Industrial and Applied Mathematics division of the Australian Mathematics Society, a member of the advisory committee for both the University of Wollongong School of Mathematics and Applied Statistics and the Australian Mathematical Society Membership Committee, a member of Mathematicians in Schools, and contributor to many outreach events.

Melanie received her PhD in applied mathematics from the University of Western Australia in 2012, and holds degrees in mathematics, education and science communication.

Following a short stint working for the Department of Fire and Emergency Services in Western Australia, Melanie joined IBM Research Australia in Melbourne before coming to ARI.

'At ARI, Dr Roberts will draw on her experience in applied and industrial mathematics to investigate how changes in land use management will help improve the health of the Great Barrier Reef.'

PhD Conferrals:

Lorelle Holcroft
Supervisor: Professor Jane Hughes

Shimaalsadat Ziajahromi
Supervisor: Associate Professor Frederic Leusch

Thuc Phan
Supervisor: Associate Professor Jim Smart

Man Xiao
Supervisor: Professor Michele Burford

Rajapaksha Pedilage Dayani Gunathilaka
Supervisor: Associate Professor Jim Smart

Dibesh Karmacharya
Supervisor: Professor Jane Hughes

Sharmeen Rahman
Supervisor: Professor Jane Hughes

Heather Haines
Supervisor: Professor Jon Olley

Luis Alonso Gomez Lemos
Supervisor: Associate Professor Guillermo Diaz-Pulido

Md. Rakeb-Ul Islam
Supervisor: Professor Jane Hughes

Juan Tao
Supervisors: Professor Stuart Bunn, Associate Professor Mark Kennard

Orpheus Butler
Supervisor: Professor Chengrong Chen

Tyson Martin
Supervisor: Professor Rod Connolly

Hangyong Lu
Supervisor: Professor Bofu Yu

Katherine Parsons
Supervisor: Dr Justine Kemp

Laurisse Luke
Supervisors: Professor Fran Sheldon, Associate Professor Mark Kennard

New ARI PhD students and Research Topic:

Miss Naima Iram

Methane emissions of wetlands versus other land uses in the Great Barrier Reef catchment

Ms Julia Smith

Assessing the toxicological status of sharks as apex predators in the Australian marine ecosystem

Miss Jagriti Tiwari

Integration of MUSLE and GIS for improved sediment yield prediction for GBR catchments in Queensland

Miss Emma Henderson

The impact of novel riparian zones on stream invertebrate assemblages and oviposition site selection

Miss Rebecca Jackson

The role of marine biogenic aerosol emissions in local climate regulation in the Great Barrier Reef

Mr Dong Kim

Remediation of closed landfills: opportunities for multi-benefit phytocaps

Mr Xiangyu Liu

Developing sensitive soil health indicators of Australia agricultural land

Miss Oluchi Mbachu

Integrating water sensitive urban design into the circular economy

Miss Mariah Millington

Current and future threats of invasive species on sensitive inland freshwater ecosystems

Visitors:

Visiting scholars:

Ms Emma Aubert
ENGEES Engineering School, France

Ms Tiranan Buddawong
Mahidol University, Bangkok, Thailand

Ms Vladimira Dekanova
Technical University in Zvolen, Slovakia'

Ms Emily Hourahane
The Queen's University of Belfast, UK

Ms Jeanne Ibarra
Bordeaux University, France

Ms Camille Laurent
Paul Sabatier University, Toulouse, France

Ms Jiatan Liang
Nanjing University Jinling College, China

Ms Ella Middelhoff
University of Osnabrück, Germany

Mr Ali Mobadersani
Tabriz University, Iran

Mr Marco Melo Neves
National Water Agency, Brazil

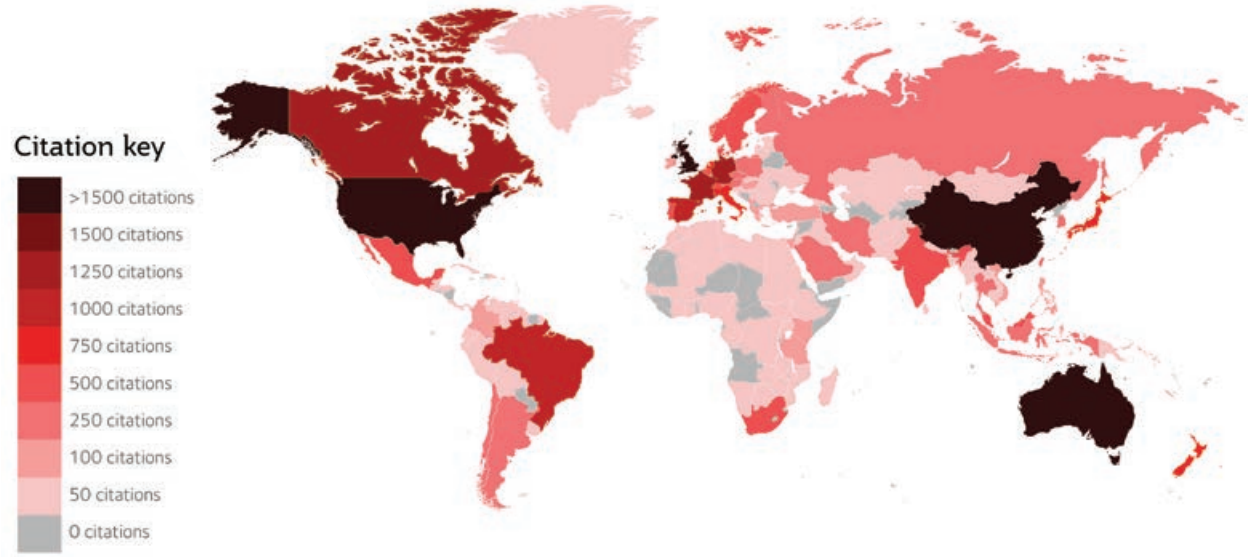
Dr Simon Courtenay
School of Environment, Resources and Sustainability
University of Waterloo, Canada

Dr Yuzhu Zhang
Northwest University, China

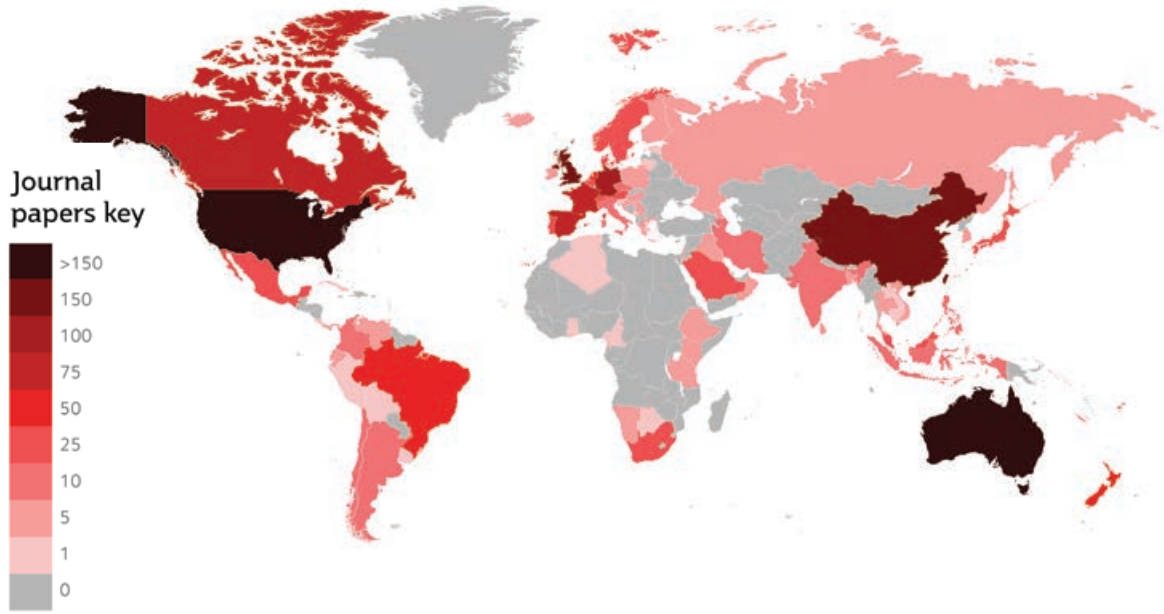
Associate Professor Jianwei Zhao
College of Resources and Environment of Huazhong Agricultural University

ARI researchers have a strong network of international collaborators and our science is having a significant impact around the world

Journal citations



Journal papers co-authored



(All map data figures captured from year of Institute establishment 2006 until June 2018).

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