ARC ceed

Centre of Excellence for Environmental Decisions

# 2015 Annual Report

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**ARC Centre of Excellence**
**for Environmental Decisions**

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# OUR CENTRE

Despite the planet facing the sixth mass extinction of species, most conservation management is not efficient or evaluated. In Australia and around the world, biodiversity and environmental problems have not been properly formulated and mistakes have been made in allocating scarce resources.

## Our Vision

To be the world's leading research centre for solving environmental management problems and for evaluating the outcomes of environmental actions.

## Our Mission

We will benefit environmental science, policy and management across Australia and around the world by solving complex problems of environmental management and monitoring in a rapidly changing and uncertain world.

The Centre of Excellence for Environmental Decisions (CEED) commenced in 2011 with funding from the Australian Research Council (ARC). ARC Centres of Excellence are world class, internationally competitive research teams investigating, and finding solutions to, challenging and important Australian and international problems. Since 2011, CEED has been pushing the frontiers of environmental decision science. Our aim is to benefit environmental science, policy and management across Australia and around the world by solving complex problems of environmental management and monitoring in a rapidly changing and uncertain world.

CEED is a partnership of five collaborating organisations (University of Queensland, University of Melbourne, Australian National University, RMIT University and University of Western Australia) and five partner organisations, (CSIRO, Trinity College Dublin, Imperial College London, Hebrew University of Jerusalem Israel and the US Geological Survey). Its operations are managed from the University of Queensland in Brisbane.

Our researchers are recognised as global leaders in fundamental environmental science and we put a high priority on the career development of the next generation of conservation researchers. Our complement of over 100 researchers — chief investigators, partner investigators, Postdoctoral Fellows and senior researchers, and PhD students — collaborate extensively across node and disciplines. We see this collaborative culture as the key to our success.

Further information on the Centre and activities can be found at our website **www.ceed.edu.au**.

# DIRECTORS' REPORT

*Hugh Possingham*

*Michael McCarthy*

CEED's remarkable output of publications in the world's top journals, and the classical measure of citations to papers, are two areas where we perform very consistently, so we will highlight other achievements this year.

As our centre matures, we are focusing more on legacy — the contribution we will leave behind. What has CEED done that will last beyond the seven year grant of $11 million? There are three legacy areas about which we are especially happy, and where we need to consolidate substantial progress to fully realise the benefit.

First, and most importantly, we bathe in the success of our early career researchers. CEED is old enough to have started to fledge offspring to far flung universities such as Cambridge, Berkeley, Imperial College, Leeds, Lincoln, Ottawa, Sheffield, and Southampton, as well as some closer to home (Charles Darwin, Deakin, James Cook, Melbourne, Monash). In addition to these continuing positions, CEED's early career researchers have been successful at winning highly competitive research fellowships including ARC Discovery Early Career Researcher Awards, Victorian Postdoctoral Research Fellowships, John Stocker Postdoctoral Fellowship and Centenary and McKenzie Fellowships at Melbourne. Their success — aside from being a product of their own brilliance — is in part due to the CEED brand. More and more universities are seeking quantitatively-oriented ecologists — the discipline of conservation research is not just blooming, it is evolving to demand people who can bring decision science tools to bear on practical problems.

Secondly, CEED has had impact on policy and management, and that impact is accelerating. While we cover specific examples of impact in this and previous annual reports, one of our most influential and pervasive impacts is hard to measure: that major global environmental non-government organisations and some governments now see decision-science thinking as part and parcel of their work. The daily work of these organisations now integrates various ideas arising from CEED, changing their culture forever. These ideas include setting measurable objectives, choosing cost-effective actions, evaluating the return on investment from monitoring data, and fully-integrated spatial planning.

And finally we raise something a little left field — cooperation. CEED is a refreshingly cooperative centre and that cooperation is infectious. Before the 1990s, ecology was a lot like many other sciences, filled with individually brilliant researchers working alone, or in small labs of two to five people. The advent of the National Science Foundation (and State of California) funded National Center for Ecological Analysis and Synthesis (NCEAS) in Santa Barbara set a new benchmark for cooperation. Researchers came from all over the world to work on specific problems in groups of 10 to 15. The only rule was that new data could not be collected — but collective thinking and collaboration was mandatory. NCEAS transformed ecology and CEED has adopted the NCEAS model.

We have created an integrated and cooperative centre where people are not frightened to share their ideas, models, problems and data — invariably through our frequent NCEAS-style working groups — and the results are remarkable.

Creating a culture of cooperation takes time but generates dividends in terms of international connections, co-authored papers and grants, and publications in the world's best journals. Intriguingly, some of our most interesting recent publications in conservation decision-making are about the benefits of collaboration and cooperation between organisations and governments.

In our last two years we must renew our focus on CEED's legacy in terms of training, impact and fundamental discovery. Cementing these gains will consume a lot of our energy.

*Hugh Possingham*
Director

*Michael McCarthy*
Deputy Director

# GOVERNANCE AND MANAGEMENT

The Centre's governance structure reflects the emphasis on strategy, research, and communication and outreach that underpin planning and implementing the work programs. Figure 1 illustrates the governance and operating structure of the Centre.

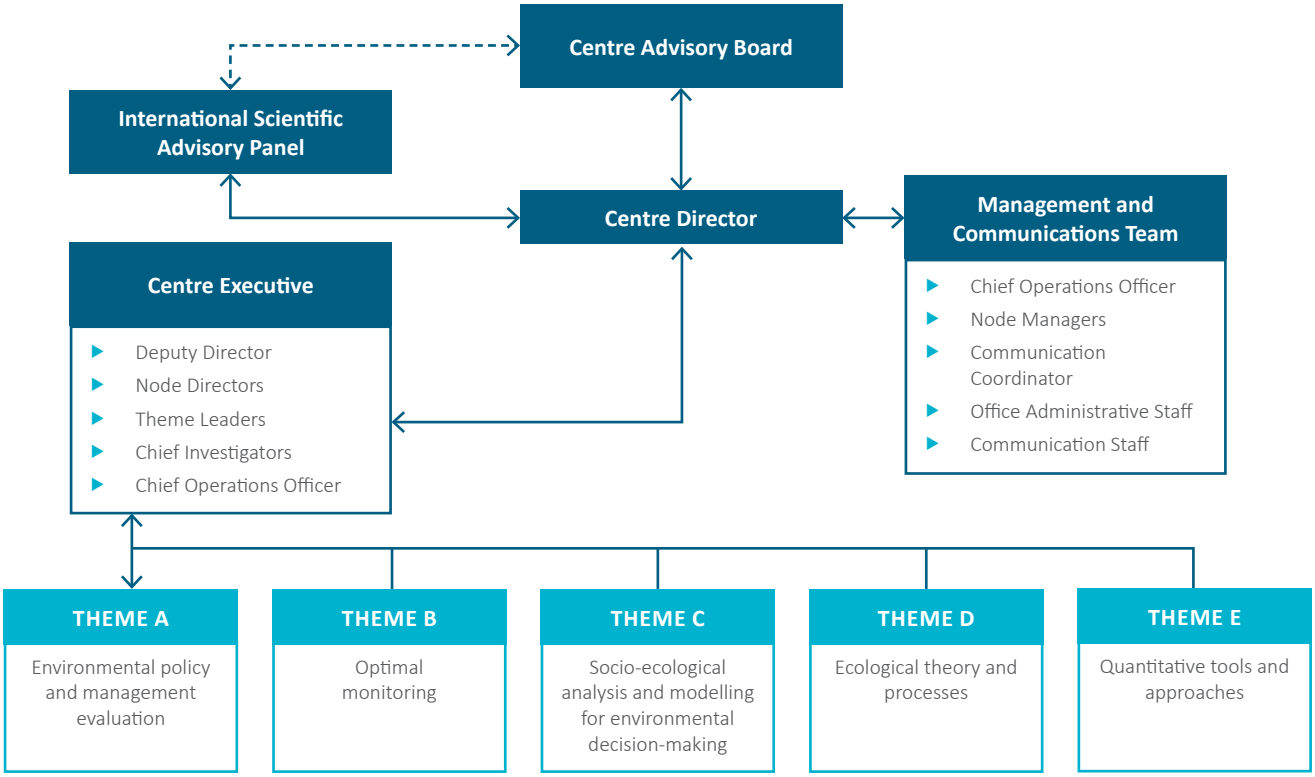



FIGURE 1 CEED's organisational structure

## CENTRE ADVISORY BOARD

A Centre Advisory Board comprising members across the research, industry, policy and philanthropic sectors oversees CEED.

The Board provides strategic advice to the Centre's Executive leadership team with a particular focus on governance, communication, impact, outreach and research management.

The Board held its annual meeting in April 2015 in Brisbane, with discussions focusing on the mid-term review outcomes, planning for the next three years, leveraging international engagement, improving benchmarking, and increasing the impact of our research.

*Members:*

- Professor Stephen Walker (Chair), University of Queensland
- Professor Andrew Cockburn (FAA), Australian National University
- Professor Alistar Robertson, University of Western Australia (ret)
- Professor Charlie Zammit, Commonwealth Department of the Environment (ret)
- Dr Margaret Byrne, Western Australian Department of Parks and Wildlife
- Mr David Shelmerdine, Myer Foundation

*Ex Officio Members*

- Professor Hugh Possingham (Director), University of Queensland
- Professor Michael McCarthy (Deputy Director), University of Melbourne

## INTERNATIONAL SCIENTIFIC ADVISORY PANEL

The function of the International Scientific Advisory Panel (ISAP) is to ensure CEED remains at the forefront of international research in environmental decision science. The ISAP is particularly important for helping the Centre to enhance its international linkages and show international leadership in its discipline. The ISAP has five members, all of whom are world leaders in pure and applied ecological research.

The ISAP met in August 2015 at the International Congress for Conservation Biology Conference in Montpellier, France. Key discussions related to: the need for CEED to expand its attention to the use and uptake of the science by the end users and stakeholders; the possible establishment of an Environmental Decisions Alliance (EDA) which will initially coordinate research workshops; promoting environmental decision-making science on a larger, international scale; and leading the establishment of a Decision Science for Nature Conservation conference in 2020.

*Members:*

- Professor Antoine Guisan, University of Lausanne
- Professor Peter Kareiva (FNAS), Chief Scientist and Director of Science, The Nature Conservancy
- Professor Claire Kremen, University of California, Berkeley
- Professor Bill Murdoch (FNAS), University of California, Santa Barbara
- Professor Bill Sutherland, Miriam Rothschild Professor of Conservation Biology, Cambridge University

## OUR PARTNERSHIPS

The collaborative partnerships within CEED ensure the research is of a consistently high quality and pushes the frontiers of environmental decision science. The partners are core to CEED's operating structure and include:

### *Collaborating organisations*

- The University of Queensland (UQ)
- The University of Melbourne (UM)
- The Australian National University (ANU)
- RMIT University (RMIT)
- The University of Western Australia (UWA)

### *Partner organisations*

- CSIRO
- Trinity College Dublin
- Imperial College London
- Hebrew University of Jerusalem, Israel
- US Geological Survey

## CENTRE EXECUTIVE

The Centre's Executive guides our operations and consists of the Theme Leaders, Node directors, Chief Investigators, and the Chief Operations Officer. The Director, Professor Hugh Possingham, and Deputy Director, Professor Michael McCarthy, provide the overarching guidance and day-to-day leadership of the Centre and its research.

The Executive meets monthly via teleconferences or face-to-face at events to discuss Centre management, research, operations and policy.

### *Executive members*

- Professor Hugh Possingham (Director), UQ
- Professor Michael McCarthy (Deputy Director), UM
- Professor David Lindenmayer, ANU
- Professor David Pannell, UWA
- Associate Professor Jonathan Rhodes, UQ
- Associate Professor Kerrie Wilson, UQ
- Associate Professor Sarah Bekessy, RMIT
- Associate Professor Brendan Wintle, UM
- Dr Michael Bode, UM
- Professor Richard Hobbs, UWA
- Associate Professor Salit Kark, UQ
- Dr Eve McDonald-Madden, UQ
- Dr Anthony Richardson, UQ
- Associate Professor Peter Vesk, UM
- Ms Melanie King (Chief Operations Officer), UQ

### *Centre management and communications team*

The Centre continues to deliver high-quality outputs and is ably supported by a team of professional staff across the five collaborating partner nodes: Chief Operations Officer, Melanie King (UQ); Node Managers — Dolla Boutros (UM), Claire Shepherd (ANU), Heather Gordon, Caroline Mitchell and Tamara Harold (UWA); administrative and support staff — Heather Christensen (UQ), Pauline Byron (UM), Tabitha Boyer (ANU), Jane Campbell, Melisa Lewins and Dominique Pomfret (UQ); and communication and engagement staff — Gabrielle Sheehan (Currie Communications), Karen Gillow (UQ), and David Salt (ANU).

The team plays an important role in supporting the Centre's core functions of research, research training and mentoring, events, communication and outreach.

# 2015 HIGHLIGHTS

**14** Chief Investigators

**53** Postdoctoral Fellows

**76** PhD Scholars

**181** peer-reviewed journal publications

**16** conference proceedings

**54** national collaborating institutions

**56** international collaborating institutions

**22** countries involved in collaborations

**61** international visitors

**5** training programs

**16** PhD graduations

**15** international plenaries

**121** international presentations

**10** national plenaries

**55** national presentations

**183** government, industry and community briefings

**45** submissions to government on policy-related matters

**52** public talks

**65** memberships on national and international boards and committees

**26** workshops organised by CEED

# OUR RESEARCH

CEED seeks to be the world's leading research centre for solving environmental management problems and for evaluating the outcomes of environmental actions.

Working across five thematic areas, our research benefits environmental science, policy and management across Australia and globally, by tackling the complex problems of environmental management and monitoring in a rapidly changing and uncertain world.

**CEED'S FIVE KEY THEMES ARE:**

| | |
|---|---|
| THEME A | Environmental policy and management evaluation |
| THEME B | Optimal monitoring |
| THEME C | Socio-ecological analysis and modelling for environmental decision-making |
| THEME D | Ecological theory and processes |
| THEME E | Quantitative tools and approaches |

Led by dedicated theme leaders with teams composed of senior, mid-career and early career researchers, our research is coordinated and integrated across these themes to achieve the overall objectives of the Centre.

## THEME A ENVIRONMENTAL POLICY AND MANAGEMENT EVALUATION

*Leader: Assoc. Prof. Salit Kark, University of Queensland*

Theme A focuses on the needs of environmental policy makers and managers at all scales across national and international boundaries. We study and evaluate the effectiveness of environmental management actions, such as establishing protected areas, habitat and ecosystem restoration at a landscape scale and marine zoning. Our work ranges from the global and continental to local scales. Working across these scales, we explore the implications of policy and management options for biodiversity and other ecosystem and environmental processes. Research in this area is expected to contribute to the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES).

This theme is establishing new collaborations with managers and policy makers in Australia and globally on topics that include:

1. Fundamental and novel policy options
2. Environmental policy performance
3. Invasive species management

## THEME B OPTIMAL MONITORING

*Leader: Assoc. Prof. Jonathan Rhodes, University of Queensland*

Monitoring is crucial for providing information to make environmental decisions. Theme B researchers work on how to monitor efficiently and effectively in order to transform optimal monitoring into a central pillar of environmental decision making and prioritisation. CEED research focuses on identifying monitoring actions and strategies that provide the greatest environmental outcomes for the lowest cost.

This theme focuses on addressing four critical areas for monitoring:

1. How to prioritise monitoring and management investment in declining species to inform recovery planning
2. Understanding the value of learning about population demographics for managing threatened species
3. Developing better methods for linking indicators of change to biodiversity responses and prioritising investment in these indicators
4. Approaches for allocating monitoring investment to learn about ecological and social systems

## THEME C SOCIO-ECOLOGICAL ANALYSIS AND MODELLING FOR ENVIRONMENTAL DECISION MAKING

*Leader: Assoc. Prof Sarah Bekessey, RMIT University*

This theme recognises that environmental management is, by definition, a social and political process, so responses to environmental problems must focus at least in part on human behaviour and social preferences.

Our researchers build on techniques from a range of disciplines, and develop methods to analyse, model and integrate knowledge about socio-economic and ecological processes to improve environmental decision-making.

Our research will encompass:

1. Integrating human responses to climate change into conservation planning, developing an integrated decision framework
2. Reconciling the triple bottom line of social equity, economic return, and environmental benefits in conservation decision making
3. Modelling the social dimensions of market based instruments for biodiversity conservation
4. Evaluating environmental research and its accountability

## THEME D ECOLOGICAL THEORY AND PROCESSES

*Leader: Assoc. Prof Peter Vesk, University of Melbourne*

Theme D focuses on the ecology of novel ecosystems, fragmented landscapes, and disturbances by looking at various patterns and processes for determining species abundance, distribution and interactions between species and the environment.

The theme's research provides a critical understanding for managers and policy makers who are involved in the decision-making process.

Our research addresses four major areas:

1. Population ecology, including the definition of invasive species, the effects of urban development on populations and the study of general patterns in population dynamics
2. Species traits, with community assembly and model validation as foci
3. Multi-species interactions, particularly in relation to invasive species and assisted colonisation management in the face of climate change
4. Ecosystem resilience and effective ecosystem interventions, including a major meta-analysis on how resilience has been measured in ecological studies in a range of ecosystems worldwide

## THEME E QUANTITATIVE TOOLS AND APPROACHES

*Leader: Dr Michael Bode, University of Melbourne*

Theme E focuses on quantitative tools and approaches, extending from fundamental research into mathematical approaches to ecological questions, through to training on-the-ground managers to use decision-support tools. Key elements include detectability modelling, the IUCN's threatened ecosystems Red List, the project prioritisation protocol (PPP) scheme, structured decision making and expansion of Marxan. The team will deliver cutting edge quantitative tools, collaborate with managers and undertake training workshops bringing stakeholders together around a shared problem.

CEED researchers also ask bigger and broader questions on fundamental conservation dilemmas such as whether we should expand or better manage our protected area system. We are working on formulating the models that can underpin these basic decisions.

The Centre's research is designed to integrate and collaborate across our five themes with many projects addressing multiple themes simultaneously. In 2015, we made significant progress in taking our research forward. In the follow sections we highlight key achievements for the year, as well as showcase the impact of work which has been continuing over the years of the Centre and is now informing policy and management.

The diversity evident in the research teams — across disciplines and nodes, with national and international researchers, as well as end users from government and NGOs — demonstrates our strong collaborative culture.

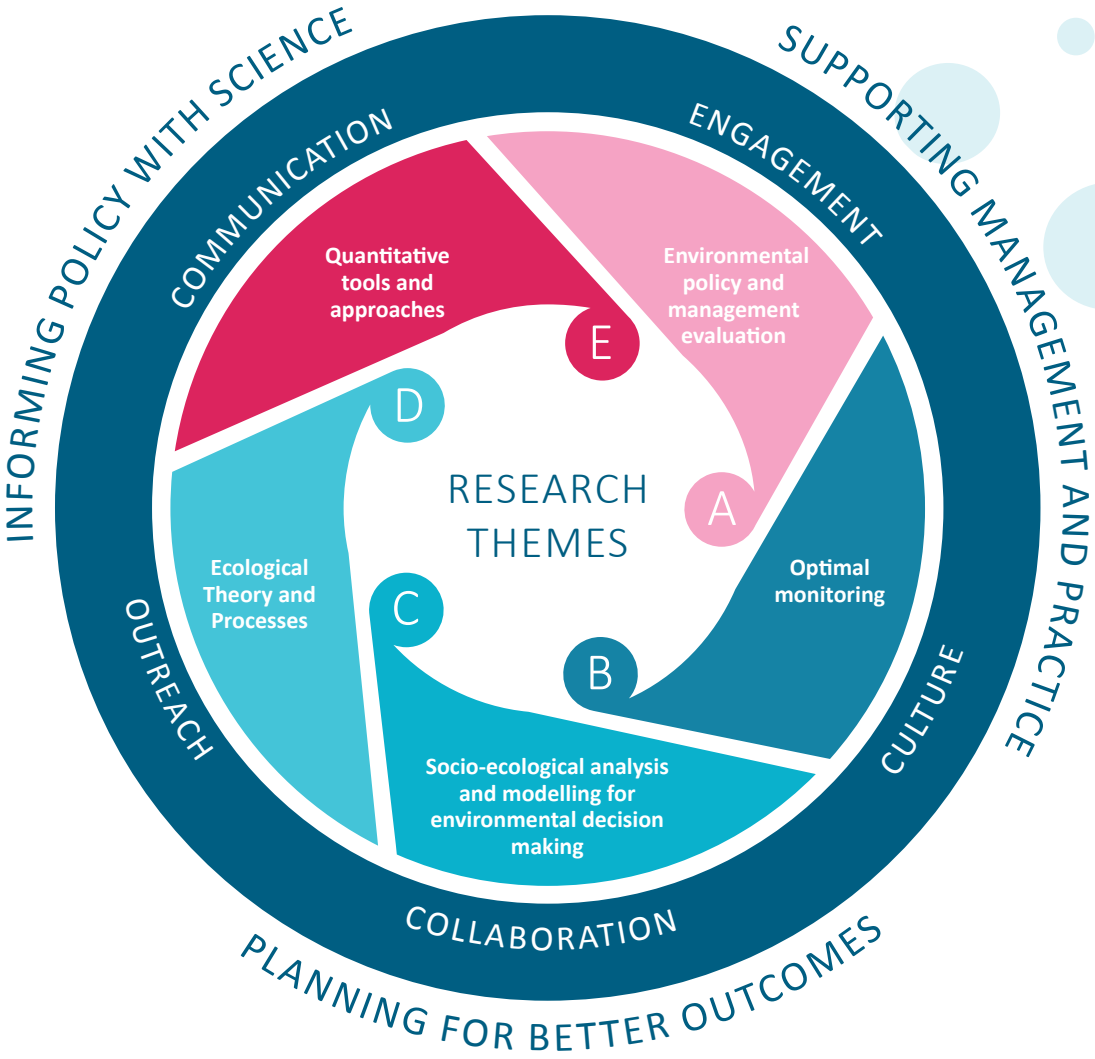



FIGURE 2 Our integrated themes are closely connected with communications, engagement and outreach activities

# PLANNING FOR BETTER ENVIRONMENTAL OUTCOMES

CEED's research seeks to inform planning in order to deliver better conservation outcomes. By working closely with practitioners, and keeping them informed of research results, our work can deliver long-term impact and the following case studies show how.

# AUSTRALIAN CITIES CRITICAL FOR THREATENED WILDLIFE

- *First worldwide study into threatened species in cities*
- *Careful planning of cities will enable retention of important habitats*
- *For 51 species more than 30% of the area they occupy in Australia is in cities or towns*

Australian cities can play a critical role in helping to conserve the country's endangered animals and plants. Work led by Dr Christopher Ives (RMIT) and Dr Pia Lentini (UM), demonstrates just how many of Australia's threatened species are actually in our cities.

In the study, published in December, the team explored the locations of Australia's 1643 listed threatened species, and the extent to which they overlapped with 99 cities or towns. They found that 500 threatened and protected species are living within city areas. For 51 species, more than 30% of the area they occupy happens to be in cities or towns.

*Of Australia's threatened and protected species, 500 are living within city areas.*

This is evidence that cities aren't just a threat to conservation, and if planners are more aware of this, habitats that are important to Australia's animals and plants are more likely to be considered. The findings highlight the importance of planning and managing our cities for conservation as well as human wellbeing.

## RESEARCH TEAM

*Christopher Ives (RMIT), Pia Lentini (UM), Caragh Threlfall (UM), Karen Ikin (ANU), Danielle Shanahan (UQ), Georgia Garrard (RMIT), Sarah Bekessy (RMIT), Richard Fuller (UQ), Laura Mumaw (RMIT), Laura Rayner (ANU), Ross Rowe (ANU, Department of Environment, UTAS), Leonie Valentine (UWA) and Dave Kendal (Australian Research Centre for Urban Ecology)*

# WILDLIFE FRIENDLY CITIES WILL MAKE US HAPPIER AND HEALTHIER

- *Four key lessons needed to promote biodiversity in our cities and towns:*
  - *— Consider the impact of urban sprawl on wildlife into adjacent habitats*
  - *— Enhancing urban greenspace provides biodiversity gains*
  - *— Large old trees need to be managed for long term sustainability*
  - *— Education and engagement connects local residents with nature and raises awareness*

It is well known that interaction with the natural environment benefits our physical and mental health. Research led by Dr Karen Ikin (ANU) demonstrates that conservation of biodiversity in urban areas has profound benefits for human wellbeing.

Australia has one of the most urbanised populations in the world, with nine out of ten people living in a city or town — therefore it is important to know what urban landscape and habitat features are good for wildlife.

Drawing on research from southeastern Australia, the research team identified four key lessons for planners on what is needed to promote biodiversity in our cities and towns:

- Consider the impact of urban sprawl on wildlife into adjacent habitats
- Enhancing urban greenspace provides biodiversity gains
- Large old trees need to be managed for long term sustainability
- Education and engagement connects local residents with nature and raises awareness

The study — Key lessons for achieving biodiversity-sensitive cities and towns — will support practitioners making decisions on ways to promote biodiversity and conservation in urban landscapes throughout Australia. Looking after plants and animals better will provide a wealth of benefits that are essential for human health and wellbeing.

### RESEARCH TEAM

*Karen Ikin, Darren Le Roux, Laura Rayner, Nelida Villaseñor, Kathy Eyles, Philip Gibbons, Adrian Manning and David Lindenmayer (ANU)*

# Gardening for wildlife

**PhD research undertaken by Laura Mumaw for her PhD under Dr Sarah Bekessy at RMIT, shows that involving urban residents in wildlife gardening as part of a collaboration between an urban council (Knox City in greater Melbourne) and community group (Knox Environment Society) provides ecological and social benefits.**

Participating residents improve habitat in the urban residential matrix to support council to conserve indigenous flora and fauna in the municipal landscape. Some participants develop a private land stewardship ethic and practice promoted in rural but not urban environments. Participants report wellbeing benefits ranging from physical and mental benefits to connections with place, community and council, and sense of hope and purpose from their contribution. The collaboration strengthens community capacity to conserve native biodiversity.

# HOW SMART ROADS CAN HELP KOALAS BEAT TRAFFIC

- *Expanding existing highways instead of building new roads is the best way to minimise the impact of increasing traffic and growing cities on wildlife*
- *CEED has developed a world-first model to determine the most cost-effective way to shield wildlife populations that live near roads*

Expansion of urban areas and the resulting increase in traffic accidents as animals cross the roads is impacting on Australian wildlife at an increasing rate. For example, more than 3800 koalas were hit by cars between 1997 and 2008 in Queensland alone, and an estimated 85% of them died as a result.

*Australian cities can prevent their wildlife ending up as road kill – if they plan their road networks more carefully.*

However Australian cities can keep their precious koalas from ending up as road kill — if they plan their road networks more carefully. The research reveals that expanding existing highways, instead of building new roads, is the best way to minimise the impact of increasing traffic and urbanisation on koalas.

The more roads koalas have to cross, the greater are their chances of being hit by cars. Therefore, putting in place a system of fewer larger roads with fewer crossings is more effective than having a larger number of smaller roads.

The team has also developed a world-first mathematical model which helps planners determine the most cost-effective way to shield wildlife populations that live near roads such as where to build fences, and over or underpasses. Using this information in the planning process will give these animals the best protection with limited conservation funds.

**RESEARCH TEAM**

*Jonathan Rhodes (UQ), Daniel Lunney (UNSW & NSW OEH), John Callaghan (AKF), Tal Polak (UQ); Clive McAlpine (UQ), Hugh Possingham (UQ), Darryl Jones (Griffith University)*

## ON GROUND IMPACT

# BUSHFIRE MANAGEMENT IN VICTORIA BOOSTED BY CEED SCIENCE

**In 2015, the Victorian Department of Environment, Land, Water and Planning released a strategic bushfire management plan for the Mallee and Murray Goulburn catchments and CEED research on fire history and biodiversity conservation has made an important contribution.**

Victoria is one of the most fire-prone areas in the world. In past decades, bushfires have had devastating impacts on communities, the economy and the environment. This is the first strategic bushfire management plan for the Mallee and Murray Goulburn bushfire-risk landscape, one of Victoria's seven bushfire-risk landscapes. It uses a risk-based approach to planning for bushfire management, and seeks to pair local knowledge with world-leading bushfire simulation software, historical data and the best available science to understand how bushfires behave.

Part of the science underpinning the strategic plan is a study led by CEED's Dr Luke Kelly at the University of Melbourne. Kelly's study applies what we know from fire histories to help conserve biodiversity. The research is now helping to predict how planned burning influences risks to biodiversity.

The researchers developed a method for determining the optimal fire history of a given area for biodiversity conservation by linking tools from three fields of research: species distribution modelling, composite indices of biodiversity, and decision science. By clearly defining fire management objectives based on the habitat requirements of fire-sensitive species in a community, this approach can help maximise biodiversity in fire-prone regions and nature reserves.

This will allow land managers to consider the trade-off between protecting people and conserving wildlife when applying planned burning.

The management strategy aims to keep native animal and plant populations healthy, while mitigating risks to life and property. The northern Mallee parks are some of the most intact areas of public land in Victoria and are home to fire-sensitive plant and animal species, many of which are endangered.

The research indicated how much area of vegetation in each post-fire growth stage is needed for healthy animal populations. Along with additional work produced by teams at University of Melbourne and La Trobe University, this study contributed to the development of Victoria's fuel management strategy.

An important next step will be to predict the impact of bushfires on biodiversity under alternative scenarios of planned burning and climatic changes. In 2016, Kelly is leading an ARC Linkage Project with scientists from the University of Melbourne, La Trobe University, the Bushfire and Natural Hazards CRC, and the Victorian Department of Environment, Land, Water and Planning.

# INFORMING POLICY WITH SCIENCE

Policy makers need to be well informed when making policy decisions for long-term conservation outcomes. CEED researchers are building the scientific knowledge base to support improved environmental decisions and sharing this with policy makers to support their work.

Supporting the Centre's increasing efforts to provide credible evidence to inform policy, CEED researchers undertook 183 briefings during the year to exchange information and ideas with a range of government, industry and business agencies. In addition to the briefings, Centre-based researchers made 45 submissions to government on policy-related matters. A few examples based on CEED's research include the EPBC Act, Commonwealth Marine Reserves Review, and Queensland land clearing policy, and provision of advice to the Israeli government on invasive species based on research undertaken through CEED within Australia to name a few.

**183**

briefings during the year with government, industry and business

# SCIENTISTS PROPOSE POLAR PROTECTION PLAN

- *Pollution, overfishing and invasive species in both northern and southern Polar Regions should be tackled immediately to boost the poles' ability to withstand climate change*
- *Sharing and incorporating lessons learned between poles will help successful responses to these challenges — and help keep the polar regions intact as humanity comes to grips with preventing global warming*

International scientists have proposed a new pathway for saving the Arctic and Antarctic from their greatest menace — climate change.

The world should tackle immediate threats like pollution, over-fishing and invasive species in both the northern and southern polar regions to boost their ability to withstand climate change, CEED research proposes.

Climate change remains the greatest threat to the Arctic and Antarctic — but there is much that can be done right now to alleviate its impact on the polar regions.

CEED researchers have found that knowledge of threats that currently plague both poles can help conserve the Polar Regions in the short to medium term. Despite being at opposite ends of the planet, the Arctic and Antarctic share many characteristics that make them vulnerable to the same threats. Both poles are susceptible because their low temperatures delay their recovery from disturbances, and both may become more attractive for natural resource exploitation, as more accessible resources elsewhere are depleted.

The study undertaken by Drs Bennett and Shaw and made public in September recommends the best way to tackle all threats is to share what has been learned at either pole. Examples include:

- Transfer technology that was developed to clean up pollution in the Arctic to the Antarctic (underway)
- To slow the spread of invasive species in the Arctic, adapt biosecurity measures used at key entry points in the Antarctic
- Quickly share new information on emerging pollutants between both hemispheres, given how these chemicals accumulate at the poles. Swift reductions or bans can then be implemented in both hemispheres before contamination becomes serious.
- Encourage international cooperation on fisheries protection in both polar environments. Currently Marine Protected Areas in the Arctic are too few, and there needs to be more effective regulation of new fishing areas is required to ensure that the stocks are properly maintained.

## RESEARCH TEAM

*Joseph Bennett (UQ), Justine Shaw (UQ & AAD), Aleks Terauds (AAD), John Smol (Queen's University, Canada), Rien Aerts (VU University, Amsterdam), Dana Bergstrom (AAD), Jules M Blais (University of Ottawa, Canada), William Cheung (UBC), Steven L Chown (Monash), Mary-Anne Lea (UTas), Uffe N Nielsen (UWS), Daniel Pauly (UBC), Kenneth J Reimer (Royal Military College of Canada), Martin Riddle (AAD), Ian Snape (AAD), Jonathan S Stark (AAD), Vivitskaia J Tulloch (UQ), and Hugh Possingham (UQ)*

# MAJOR SHORTFALLS IDENTIFIED IN MARINE CONSERVATION

- *Globally, scientists found more than 17,000 species of marine life remain largely unprotected*
- *Study provides guidance on where new protected areas should be sited*
- *USA, Canada and Brazil among nations with most unprotected species*

More than 17,000 marine species worldwide remain largely unprotected, with the USA among the worst in supporting formal marine protected areas (MPAs) that could safeguard marine biodiversity.

The study launched in December, is the first comprehensive assessment of protected areas coverage of marine life and was undertaken by researchers from UQ, the University of California Santa Barbara, the National Center for Ecological Analysis and Synthesis, Imperial College London and the Wildlife Conservation Society.

The research team looked at the ranges of some 17,348 species of marine life, including whales, sharks, rays and fish, and found that 97.4% have less than 10% of their range represented in marine protected areas. Nations with the largest number of "gap species" or species whose range lie entirely outside of protected areas include the USA, Canada and Brazil.

The study underscores opportunities to achieve goals set by the Convention on Biological Diversity to protect 10% of marine biodiversity by 2020. For example, the majority of species that were considered very poorly represented (less than 2% of their range found in MPAs) are found in exclusive economic zones. This suggests an important role for particular nations to better protect biodiversity.

The process of establishing MPAs is not trivial as they impact livelihoods. It is essential that new MPAs protect biodiversity whilst minimizing negative social and economic impacts. This study offers strategic guidance to policy makers on where MPAs could be placed to better protect marine biodiversity.

The study notes that it is imperative new MPAs are systematically identified and take into account what has already been protected in other places, in addition to socioeconomic costs of implementation, feasibility of success and other aspects driving biodiversity.

### RESEARCH TEAM

*Carissa Klein (UQ), Christopher Brown (UQ & GU), Benjamin Halpern (Imperial College, London, UC Santa Barbara & NCEAS, Santa Barbara), Daniel Segan (WCS, USA), Jennifer McGowan (UQ), Maria Beger (UQ), James Watson (UQ & WCS, USA)*

# NEW WAY TO SAVE FISH....AND FISHERS

- *Well-enforced fishing areas can boost incomes of fishers by up to 50%*
- *Findings on the substantial benefits of well-enforced marine areas can be applied to oceans and fisheries worldwide*
- *Study recommends governments everywhere provide subsidies and training programs to support programs regulate fisheries better, and enforce those regulations*

CEED researchers have found that well-enforced fishing areas can boost the incomes of fishers by up to 50% through catching more fish, compared with those fishing in unregulated 'anything-goes' areas. Protecting both the world's ocean life and the livelihoods of fishers creates a win-win situation for both fishing communities and conservation.

The study, part of Katrina Davis' PhD with CEED, also has important benefits for Australia, particularly as Australia considers increasing its marine reserves and regulated fishing zones. The research found that the cost of managing these areas can be offset by larger profits for fishers as well as tourism in places such as the Great Barrier Reef or Ningaloo Coast.

With uncontrolled industrial and consumer demands driving over-fishing in the world's oceans, reserves and regulated fishing are being established in certain locations — all of which allow fish stocks and fisheries to recover. However, the effectiveness of these systems depends on support from coastal fishing communities, whose livelihoods may be affected by no-take or regulated fishing zones where catch is restricted.

The researchers used Chile — one of the world's top 10 exporters of fish and fishery products — as a case study to identify how fishing incomes can be protected while anti-poaching rules are enforced. They reviewed Chilean abalone which is managed through a program called Territorial User Rights for Fisheries (TURF).

The study showed that fishers earned more in enforced-TURF zones than they did in open-access areas, with every (US) dollar spent on enforcement yielding an increase of between US$4-9 in fishing revenue. The returns show that the benefits are significantly higher than the cost of preventing poaching. This means that, as well as furthering conservation, enforcement of regulated fishing areas is justified by higher incomes for fishers.

The research also found that fishers operating in open-access areas are much more likely to exceed safe catch limits — and drive down fish abundance.

### RESEARCH TEAM

*Katrina Davis (UWA), Marit Kragt (UWA), Stefan Gelcich (UWA), Steven Schilizzi (UWA), David Pannell (UWA)*

# STUDY TACKLES CONFLICTING GOALS IN THE CORAL TRIANGLE

- *New approach allows nations to coordinate actions and achieve multiple goals at the same time*
- *Recommendations will be used to improve the Coral Triangle countries' Regional Plan of Action*
- *Framework can be adapted to guide conservation investments worldwide where countries are committed to multi-national goals*

An international team of scientists, led by Dr Maria Beger (UQ), is working in the Coral Triangle of Southeast Asia to pioneer a new approach that conserves wildlife, protects people's livelihoods and helps both adapt to climate change.

The researchers have developed a framework that gives countries around the Coral Triangle the choice to prioritise either multi-objective hotspots that benefit many different management goals and species, complementary areas that benefit particular goals and species, or a combination of both.

Outlined in a study published in September, the framework provides the countries with the flexibility to help secure the precious resources of the Coral Triangle within their means. Each country has its own agenda, and some have fewer resources to spare than others. Within the Coral Triangle, achieving so many contrasting goals simultaneously is enormously challenging due to the social and ecological diversity. This is why studies such as the one undertaken by Dr Beger and the team are so important, as it allows nations to coordinate their actions and achieve many social, environmental and economic goals at the same time.

Spread over six million square kilometres of ocean around Southeast Asia and the western Pacific, the Coral Triangle is one of the planet's most important coral reef regions; it harbours over 500 species of hard coral, 3000 species of fish and the world's largest mangrove area. These resources supply food and support the livelihoods of an estimated 500 million people, and are of immense importance to the social and economic stability of the Asia-Pacific region.

The task of protecting this vast and vital region is carried out through the Coral Triangle Initiative on Coral Reefs, Fisheries and Food Security (CTI-CFF) which covers Indonesia, the Philippines, Malaysia, Timor Leste, Papua New Guinea and the Solomon Islands. The team was asked by the member countries how best to co-ordinate and prioritise their actions to achieve goals which are sometimes contrasting and conflicting.

The CTI-CFF has set regional conservation objectives that include protecting marine habitats; protecting fish and threatened sea turtle populations and breeding grounds; conserving coral reefs most likely to survive climate impacts; and encouraging the larval dispersal of commercially important fish species. The researchers pinpointed areas that met all or most of these conservation objectives, as well as places that met one objective very well.

Investing in places where multiple goals can be achieved is an important strategy, but prioritizing locations that are most important for a single goal like saving a particular species or ecosystem, is equally important. CEED research addressed how to balance competing and conflicting objectives to achieve sustainable outcomes.

The team worked together to protect the multi-objective hotspots or complementary areas that also help protect fishermen and village livelihoods. For the first time the team had access to the migration routes of turtles in the Coral Triangle, thanks to the data provided by various groups in the region. Maps were created of how each area connects with each other, and used to determine the numbers of turtles that travel between the different reefs — all 17,000 of them.

The framework can be adapted to guide conservation investments worldwide where countries are committed to multi-national goals, but implement conservation actions independently.

The Executive Director of Regional Secretariat, CTI-CFF, Dr Widi Pratikto says the study's recommendations "will greatly benefit coral reef conservation management and its implications in our region. Such recommendations will greatly benefit us by improving our Regional Plan of Actions (RPOA). In particular, this includes strategic expansion of the region's network of marine protected areas."

### RESEARCH TEAM

*Maria Beger (UQ), Jennifer McGowan (UQ), Eric Treml (UM), Alison Green (Nature Conservancy), Alan White (The Nature Conservancy), Nicholas Wolff (UQ), Carissa Klein (UQ), Peter Mumby (UQ) and Hugh Possingham (UQ)*

# COLLABORATION CAN SAVE FORESTS AND BILLIONS OF DOLLARS

- *Governments' land use plans are inadequate, and will fall significantly short of meeting their conservation goals*
- *The Heart of Borneo initiative, which aims to manage 20 million hectares of the island's mountain areas, is less cost-efficient than the integrated planning approach*
- *Binding agreement is recommended to ensure that the best development and conservation plans are implemented in each national jurisdiction*

International scientists including scientists from CEED, have urged the three nations who share the Asian island of Borneo to collaborate more closely to save their endangered wildlife and meet development goals.

By coordinating conservation and development efforts as well as reforming land-use, Malaysia, Indonesia and Brunei could retain up to half of the land of Borneo as forests, protect elephant and orangutan habitats, reduce carbon dioxide emissions by 50%, and possibly significantly reduce opportunity costs by billions of dollars.

A study published in April, reveals that the governments' current land-use plans are inadequate, and will fall significantly short of meeting their conservation goals. The researchers found that integrated planning between the three nations, including coordinating conservation and development plans, and allowing changes to existing land-use allocations, will achieve substantial savings while requiring less land for protected areas. It will also deliver the greatest area for reduced impact logging — logging practices that are better for the environment.

The team also found that the Heart of Borneo initiative, which aims to manage 20 million hectares of the island's mountain areas, is less cost-efficient than the integrated planning approach. This is because while the initiative will keep much of the uplands as forests, much of the lowlands, where orangutans and elephants mainly live, will be cleared.

### RESEARCH TEAM

*Rebecca Runting (UQ), Erik Meijaard (Borneo Futures Project & Centre for International Forestry Research, Indonesia), Nicola Abram (UQ), Jessie Wells (UQ), David Gaveau (Center for International Forestry Research, Indonesia), Marc Ancrenaz (Borneo Futures Project), Hugh Possingham (UQ), Serge Wich (Liverpool John Moores Uni, UK), Fitrian Ardiansyah (IDH — The Sustainable Trade Initiative, Netherlands), Melvin Gumal (WCS Sarawak), Laurentius Ambu (Sabah Wildlife Dept, Malaysia), Kerrie Wilson (UQ)*

# TROPHY HUNTING MAY BE A KEY TO SAVING WILDLIFE

- *Controlled trophy hunting may be required to ensure endangered wildlife survives*
- *Trade-offs are needed to conserve animals through helping local communities generate income*

The world may need to allow controlled trophy hunting of elephants, lions and other animals if it wants to keep its endangered wildlife.

Research undertaken by Dr Duan Biggs (UQ) shows that trophy hunting of elephants and lions — managed well — is critical for the wellbeing of local communities in low-income countries, and in turn the successful conservation of the animals and their habitats.

Managed hunting means that only carefully selected animals such as old or dying animals are hunted to ensure sustainability, and only allowing the export and import of trophies from operators that follow best practices. Without this, the poaching and illegal trade in wildlife products will thrive, as impoverished local communities have no incentive to protect the animals, and may even be driven to poach them or join the illicit trade.

The research is finding many local people run community conservancies in which they actively protect their wildlife. This includes looking out for poachers and leaving woodlands intact for the animals, rather than clearing these areas to plant low-yielding crops.

Incentives to discourage local people from poaching, as the yield pays the wages of those who work on conservation, helps build the community's infrastructure, or contributes to households and livelihoods.

Research shows that community conservancies have helped to boost Namibia's elephant population from 7500 to 20,000 between 1995 and 2013 while the range of lions has expanded to outside of state protected areas in the same period.

This increase indicates that they are effectively removing some of the threats to their animals. The conservancies are successful because the people self-enforce within the community — there's much less incentive to poach if you know that your neighbour is going to report you or the community turn against you.

The research, as well as the local communities' role in combatting the worldwide poaching crisis and illegal wildlife trade, were discussed by scientists and conservation managers at a symposium on the role of communities, governance, incentives and sustainable use in combating wildlife crime held in South Africa in March. CEED was the scientific partner for the symposium led by the International Union for Conservation of Nature's (IUCN) Sustainable Use and Livelihoods Specialist Group (SULi) with the International Institute for Environment and Development (IIED), the Austrian Ministry of Environment and TRAFFIC, the wildlife trade monitoring network, the GIZ and USAID.

### RESEARCH TEAM

*Duan Biggs (UQ), Hugh Possingham (UQ), IUCN Sustainable Use and Livelihoods Specialist Group (SULi)*

# ON GROUND IMPACT

## EXPERT KNOWLEDGE HELPS TACKLE NZ WATER POLLUTION

**Over the past 20 years, dairy farming in New Zealand has boomed. Dairy now accounts for around one third of New Zealand's annual merchandise exports and is a key driver of regional growth.**

While this has benefited New Zealanders economically, there has been an environmental cost in the form of increased water pollution. New Zealand's inland water bodies have suffered higher nutrient levels, and there are concerns nutrients might continue to be delivered by groundwater for decades to come.

CEED Postdoctoral Fellow Graeme Doole from UWA has been at the forefront of efforts to identify effective and efficient strategies to reduce this water pollution. He has built sophisticated models that integrate environmental and economic aspects of the problem at scales ranging from individual farms to whole catchments with hundreds of farms. He has used these models to evaluate new practices and technologies for pollution reduction to estimate the costs to dairy farmers of achieving various pollution-reduction targets, and to identify how pollution reduction can be allocated between farms in different locations in order to achieve pollution-reduction targets at the least overall cost.

Recognising the importance and the practical relevance of Graeme's research, the New Zealand Government (Ministry for the Environment and Ministry for Primary Industries) has increasingly sought his advice on the design and implementation of new policies. At their request, Graeme has directly advised ministers and senior government officials.

In 2014–15, Graeme was seconded to the Ministry for the Environment to conduct economic evaluation of a new policy framework for water quality and quantity in New Zealand. Following this work, the Ministry for the Environment have sponsored a Chair of Environmental Economics for Graeme at the University of Waikato. He has a continuing role as an Economic Advisor, working with the Ministry for the Environment and Ministry of Primary Industries to provide further evaluation of additions to the new policy framework, guide implementation of the policy throughout New Zealand, and work with stakeholders to understand trade-offs associated with various ways of enacting the policy across diverse catchments.

# SUPPORTING MANAGEMENT AND PRACTICE

Several aspects of CEED's research directly inform environmental management practice. CEED's work supports practitioners to make better on-ground decisions in project design, planning, monitoring and evaluation. Practitioners have been involved in working with CEED researchers through a variety of mechanisms including involvement in end-user related workshops (of which 20% of attendees were end users) to discuss the science and on-ground management and policy interactions, briefings and other discussions.

# WHICH SPECIES SHOULD BE MONITORED?

- *Monitoring should be undertaken on those species that are most likely to result in a change in our decision about which species to manage*
- *New monitoring principles simplify the process of choosing which species to monitor*

Many general principles have been developed for managing biological systems, such as choosing the optimal number of reserves, or choosing whether to manage connectivity or the amount of habitat. Yet, in the sphere of monitoring biodiversity, few general principles have been identified despite a pressing need for them. In particular, simple principles to support the choice of species to monitor to achieve the best conservation outcomes have been elusive to date.

This is of particular concern as the monitoring for species declines has been and will almost certainly continue to be a fundamental component of biodiversity conservation. It is used to identify threat levels (e.g. for the IUCN Red List of threatened species), quantify extinction risk, and identify the causes of declines.

Work by CEED researcher Dr Howard Wilson with chief investigators Rhodes and Possingham has now made a major contribution to addressing this gap and developing principles for prioritising which species to monitor.

In essence, the principle is that we should monitor those species that are most likely to result in a change in our decision about which species to manage. This is one of the first simple rules for identifying species to monitor. Importantly, these simple new principles will greatly enhance our ability to cheaply and rapidly make good choices about the monitoring of biodiversity and will ultimately lead to improved conservation outcomes.

**RESEARCH TEAM**

*Howard Wilson (UQ), Jonathan Rhodes (UQ), Hugh Possingham (UQ)*

# FROG WARS: SURVIVORS EMERGE IN WAR WITH KILLER FUNGUS

- *Given enough time, some amphibian species can recover from diseases, provided that high quality habitat is protected*
- *Prevention of habitat loss is a simple solution to species preservation*

Research by CEED researchers at ANU has found that some native frogs are winning their war against the world's most devastating frog-killer — the chytrid fungus — while others are losing it.

Studies show the whistling tree frog is successfully beating the lethal fungus, as is the alpine tree frog. However the iconic yellow-and-black striped corroboree frog — a critically endangered Australian species — is fast losing the struggle. The research is also revealing what causes frogs to live or die — providing scientists with crucial clues in the fight to save the nation's remaining frogs.

High quality habitat plays an important role in minimising the diseases impacts. Many of the sites reviewed by the research team contained coarse woody debris which provided refuge for new colonisers. These ponds also had more plants and stable water levels which are needed to protect developing frog eggs and provide habitat for tadpoles.

For frogs that are losing the battle, the researchers are recommending strategies such as breeding in captivity or transferring species to environments that can help get rid of the fungus may need to be considered. Furthermore, the researchers recommend that it is crucial to maintain high quality habitats for frogs that are surviving or re-expanding their population.

**RESEARCH TEAM**

*Ben Scheele (ANU), Fiorenzo Guarino (University of Canberra), William Osborne (University of Canberra), David A. Hunter (NSW Office of Environment and Heritage), Lee F. Skerratt (James Cook University), Don A. Driscoll (ANU)*

Some native frogs are winning their war against the world's most devastating frog-killer - the chytrid fungus - while others are losing it.

# ON GROUND IMPACT

## RESTORATION ROCKS!

- *Rocks are a critical resource for many species providing refuges, basking sites and prey hot-spots*
- *Rock removal can cause declines in biodiversity*
- *Increased rock coverage can reduce fire risk*
- *Science-based restoration technique increasing the number of rocks in the landscape is being rolled out in multiple reserves across Canberra's grasslands*

Biodiversity conservation and protection of infrastructure often require different approaches for managing wildfire risk. Broad-scale prescribed burning is frequently advocated to reduce loss of homes and other buildings from bushfire even though it might be ineffective for biodiversity conservation.

As infrastructure generally has priority over nature, management agencies remain under strong pressure to maintain low fire fuel loads — a pressure that increases with rapid urbanisation.

Rocks are a critical resource for many species providing refuges, basking sites and prey hot-spots. Rock removal can cause declines in biodiversity, particularly when coupled with nutrient enrichment and associated changes in plant community composition. CEED researchers and collaborators set out to discover if we can use rocks in restoration to reduce fire fuel loads, and at the same time overcome conflicts between biodiversity conservation and asset protection.

Optimising habitat restoration for the nationally threatened pink-tailed worm-lizard, *Aprasia parapulchella*, while reducing fire fuel load in a rapidly developing urban area in Canberra, was the key focus of the research. Rocks are a critical resource for these lizards — they live in burrows under rocks where they feed exclusively on ant eggs and larvae. No rocks, no lizards.

Dense addition of natural rock (30% cover) and native grass revegetation (*Themeda triandra* and *Poa sieberiana*) were used to restore critical habitat elements. Combinations of fire and herbicide were used to reduce fuel load and invasive exotic species.

Rock restoration combined with herbicide application met the widest range of restoration goals: it reduced fire fuel load, increased ant occurrence in the short-term and increased the growth and survival of native grasses. Lizards colonised the experimental plots within a year of treatment.

This science-based restoration technique is currently being rolled out by ACT Parks and Conservation in multiple reserves across the territory. It is an innovative way to resolve conflicts between biodiversity conservation and protection of human assets from bushfire in any grassland area where rocks are a critical resource.

**RESEARCH TEAM**

*Annabel Smith (ANU), Richard Milner (ACT Parks and Conservation), Alice McDougall (ANU), Don Driscoll (ANU)*

# ENVIRONMENT AND THE BOTTOM LINE

The strong links between the environment and the economy are now increasingly recognised. CEED researchers also take into account the bottom line in different aspects of our work.

# BUSH IN THE BACK PADDOCK ADDS VALUE TO THE FARM

- *Native vegetation can add between 4% and 25% to the value of a rural property*
- *If private landholders are aware of this, they may be more likely to preserve native vegetation on their land and/or participate in conservation programs*

Native vegetation can add between 4% and 25% to the value of a rural property, according to new research undertaken by a team of resource economists led by Dr Maksym Polyakov from the University of Western Australia.

The study examined the connection between sale prices of about 7200 rural properties in North-Central Victoria and native vegetation cover on those properties, and found that the value of the native vegetation changes with the context of the land but in some situations the increased value can be considerable, adding between 4% and 25% to the value of the property.

The research found that rural landholders generally value having some native vegetation on their land, and this is reflected in land prices. The value depends on both the area of native vegetation on a property and the overall property size. For example, a farmer may value their first hectare of native vegetation highly, but the tenth hectare might add no extra value.

Conserving biodiversity on private land is an important part of our national conservation strategy. However, it can be challenging because the benefits of biodiversity are enjoyed by everyone while the costs of conservation are incurred by the landholders. If landholders understand that native vegetation on their properties can also deliver increased land value, they may be more likely to retain native vegetation or participate in conservation programs, leading to better outcomes for biodiversity over the long term.

Furthermore, natural resource managers can use this information for targeting ecological restoration. Landholders who benefit the most from additional hectares of native vegetation would be more likely to participate in a revegetation program at lower public cost.

## RESEARCH TEAM

*Maksym Polyakov (UWA), David Pannell (UWA), Ram Pandit (UWA), Sorada Tapsuwan (CSIRO), Geoff Park (Natural Decisions Pty Ltd)*

# WORKING IN THE COMMERCIAL ENVIRONMENT

Most environmental research deals with public-good issues and has at most an indirect impact on commercial outcomes. However, some research is of sufficiently broad relevance for the information to underpin commercial activity.

INFFER (the Investment Framework for Environmental Resources) was initiated by CEED Chief Investigator David Pannell (UWA) and colleagues Anna Roberts and Geoff Park in the Cooperative Research Centre for Future Farm Industries in 2008. In 2013, the team spun off a small company, Natural Decisions Pty Ltd, to provide services based on INFFER to environmental bodies around Australia and internationally.

In 2015, the company expanded to three full-time and two part-time staff.

INFFER was developed in response to research that identified three gaps in the processes used by many environmental organisations to design, evaluate and prioritise environmental investments.

Firstly, there was a need to improve the logical consistency of design of many projects. This meant ensuring that project design considered biological, physical, social, economic and administrative factors, and that there was close alignment between the ultimate project goals, the specific changes in management or use of environmental assets, the policy mechanisms used to deliver changes, and the project budget. Secondly, an improved system for selecting policy mechanisms for particular projects was needed. And thirdly, there were weaknesses in commonly used processes used to evaluate and rank potential environmental projects.

In designing INFFER, the team was careful to consider the capacities of staff in relevant organisations and the trade-off between rigorous detail and transaction costs.

Services provided by Natural Decisions Pty Ltd include application of INFFER to evaluate and rank environmental investments, and training and support to organisations that are using INFFER themselves. Clients have been based in most Australian states as well as in Canada and New Zealand. Important projects in 2015 have included analyses for several bodies responsible for management of parts of the Great Barrier Reef catchment.

The experience with INFFER demonstrates that long time lags often occur between research and real-world impacts. The research that eventually resulted in INFFER started in 2004. It led to follow-on research and various collaborations with environmental managers before the establishment of Natural Decisions after almost a decade.

In 2015, INFFER expanded to three full-time and two part-time staff.

# RECOGNITION OF RESEARCH EXCELLENCE

In 2015, several CEED researchers, including both early career and senior researchers were recognised on the national and international stage for the excellence of their research through awards, grants, appointments and invitations to share their knowledge.

**Dr Vanessa Adams and Mr Sugeng Budiharta** were selected as Young Fellows of the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES)

**Dr Jane Catford** (UM) gave the Christy Fellows Lecture at the joint ASL and New Zealand Freshwater Sciences Society conference in Wellington, New Zealand in November 2015. Jane was also awarded two new grants: (i) 2015–2019: ARC Discovery Grant: Predicting the causes and consequences of plant invasions (Duncan & Catford; $503K), and; (ii) 2015–2018: ARC Linkage Grant: Overcoming multiple constraints to wetland forest restoration (Walsh, Catford, Keatley, Raulings & Harley; $355K). She also received the 2015 Australian Society for Limnology Early Career Excellence Award

**Dr Katrina Davis** (UWA) won the award for Higher Degree by Research Achievement: 'Best work accepted for publication award,' University of Western Australia, 2015 and the Quality of Research Communication Award, Australian Agricultural and Resource Economics Society, 2015

**Dr Jane Elith** (UM) a CEED associate, received the prestigious Prime Minister's Frank Fenner Prize and an Australian Academy of Science Prize

**Ms Veronica Fernandes Gama** (UQ) received the 2015 Stuart Leslie Conference Award

**Dr Richard Fuller** (UQ) received the UQ Research Excellence Awards: Commendation for Excellence in RHD supervision

**Dr Ascelin Gordon** (RMIT) received a 2015 Vice-Chancellor's Senior Research Fellowship

**Professor Richard Hobbs** (UWA) received Thompson Reuters Highly Cited Researcher 2015 for Ecology and Environment

**Dr Luke Kelly** (UM) received a Victorian Government Science and Innovation Award — the Victorian Postdoctoral Research Fellowship will see him travel to Spain to study the threat of fires to biodiversity at the Forest Sciences Center of Catalonia

**Dr Lucie Bland and Prof Michael McCarthy** (UM) were awarded the 2015 NSW Office of Environment and Heritage Eureka Prize for Environmental Research for their work on the IUCN Red List of Ecosystems

**Prof David Pannell** (UWA) received the Vice Chancellor's Award in Research Mentorship at UWA.

**Dr Eve McDonald-Madden** (UQ), **Dr Tara Martin** (CSIRO), **Prof Hugh Possingham** (UQ), and **Prof Antoin Guisan** (Université de Lausanne) received the Thomson Reuters Citation Award for their significant contribution to research into the effects of climate change, habitat loss and conservation decisions

**Dr Eve McDonald-Madden** (UQ) received a University of Queensland Foundation Research Excellence Award in recognition of her outstanding track record in environmental decision science

**Ms Jennifer McGowan** (UQ) was awarded the ConocoPhillips Water and Biodiversity Stewardship Scholarship. The scholarship enabled her to attend a training course hosted by the Smithsonian-Mason School of Conservation, Washington DC. Jennifer was also the recipient of two travel grants ($1500) to attend the 2015 World Seabird Conference in South Africa and the UQ Graduate School International Travel Award ($5000)

**Ms Courtney Morgans** (UQ) was awarded a UQ Graduate School International Travel Award ($4,000)

**Prof EJ Milner-Gulland** accepted the position of the Tasso Leventis Chair in Biodiversity at the University of Oxford. She also received a three year grant from the UK government's Natural Environment Research Council to look at ways to improve the use and interpretation of ranger patrol data

Ms Estibaliz Palma (UM) received a 2015 University Grants Award from the Australian Wildlife Society

Ms Tal Polak (UQ) was a finalist in the Student Award for the ICCB 2015 in Montpellier, and won the best poster award in the Israeli annual meeting of Ecology and Environmental Sciences

Prof Hugh Possingham (UQ) received the degree, Doctor of Science, honoris causa from The University of British Columbia. He was also a Eureka Finalist for 2015 Prize for Outstanding Mentor of Young Researchers

Ms Keren Raiter was awarded the Plant Biology Best Paper Award for Postgraduate Research Student ($1000 prize for paper 'Under the radar: mitigating enigmatic ecological impacts' published in TREE journal)

Dr James Watson (UQ) received the Early Career Conservationist award at the 26th International Congress for Conservation Biology

Assoc. Prof Kerrie Wilson (UQ) was made an affiliate Professor at the University of Copenhagen. She received the Life Sciences Research Award at the Women in Technology (WIT) Awards and the SCOPUS Life Sciences and Biological Sciences award for research into habitat restoration for biodiversity and ecosystem conservation. She was also a finalist in the Prime Minister's Frank Fenner Prize for Life Scientist

Dr Leonie Valentine (UWA) won the Best Early Career Researcher paper, UWA School of Plant Biology

Mr Mat Hardy (RMIT) was awarded the RMIT European Union Centre travel grant to travel to ICCB in Montpellier

# Conservation research efforts recognised

**CEED researchers have won a prestigious Thomson Reuters Citation Award for their significant contribution to climate change research. Prof Hugh Possingham and Dr Eve McDonald-Madden from the University of Queensland, and Dr Tara Martin from CSIRO, were recognised for their research into the effects of climate change, habitat loss and conservation decisions.**

The research was conducted in collaboration with Dr Jane Elith (UM), Dr Chrystal Mantyka-Pringle (University of Saskatchewan, formerly UQ) and CEED International Scientific Advisory Panel member Professor Antoine Guisan (Université de Lausanne). The prize was awarded jointly.

Director of CEED Prof Hugh Possingham said there is a lot of research being done about the likely impact of climate change on plants, animals and habitats.

"Our group is more interested in research that helps people make good decisions about how to respond to a changing climate," he said.

*Eve with Jeroen Prinsen, TR Senior Director for Australasia, and David Brown, Global Head of Sales.*

# CEED shines at ICCB 2015

**The premier conservation congress of the year is the International Congress for Conservation Biology (or ICCB). In 2015 the 27th ICCB was held during August in Montpellier, France, and CEED researchers and research played many starring roles.**

We had over 70 researchers delivering seminars and presenting posters talking about the full range of environmental decision science issues — from optimal translocation and eradication through to ethics and mind-mapping.

**HIGHLIGHTS INCLUDED:**

- *Ms Keren Raiter (UWA) presenting on 'Do roads influence predator activity in intact landscapes?'*
- *Dr Luke Kelly (UM) presenting on 'Island biogeography of birds: testing core assumptions of MacArthur and Wilson 50 years on'*
- *Dr Martina Di Fonzo (UQ) presenting on 'Are "one-size-fits-all" targets for population size sensible under limited conservation resources?' and co-organising a symposia with Dr Roman Carrasco (University of Singapore) on 'Conservation trade-offs in a resource limited world'*
- *Mr Alex Kusmanoff (RMIT) presenting on 'Framing the Private Land Conservation Conversation'*

In addition to having a major input to the science being discussed at this year's ICCB, CEED also led the way in social media with ANU PhD student Megan Evans' tweets during the conference being the most retweeted and favourited out of the 1000 or so attendees posting on Twitter at the event. CEED researcher Morena Mills also scored the second most retweeted tweet with her comment on CEED Director Hugh Possingham's talk: "@HugePossum [Possingham] says young conservation biologists should not take advice from old grey men as they may make you stagnant."

# Researcher profile

## MY 2015: DR MARTINA DI FONZO

Until recently a post-doctoral research fellow at The University of Queensland with CEED, Dr Martina Di Fonzo's proudest achievement of 2015 stemmed from her research on threatened species in New Zealand.

Her paper, 'Evaluating trade-offs between persistence levels and numbers of species conserved' appeared in Conservation Letters in July and was co-authored by several prominent CEED researchers*. It explored the effect of lowering individual species persistence targets on the outcomes achieved by multi-species conservation programs.

"We studied approximately 700 threatened species, and produced three key findings related to optimal persistence targets.

"It is important to set high persistence targets, however setting a persistence target for any one species that is too high relative to the budget will waste both the budget resources and opportunities to conserve other species. Spreading a budget across too many species will also waste resources and result in fewer species being saved overall.

"Basically, our analyses demonstrate how important it is to carefully consider which targets to aim for in a multi-species conservation project, in order to achieve the greatest gains for biodiversity per dollar spent."

Dr Di Fonzo hopes that her research findings will be adopted by practitioners on the ground, who must make difficult decisions about how and where to invest their efforts on a daily basis.

In addition to publishing this paper, Dr Di Fonzo delivered a presentation examining 'one- size-fits-all' targets at the 27th International Congress for Conservation Biology.

"We worked hard on this project right up until the day of the presentation, and it was exciting to present my work to an international audience, and receive their feedback on my findings."

Dr Di Fonzo also presented her work at the British Ecological Society Annual Meeting in the United Kingdom, where she is now based.

"I am now working in the Species Programme at the United Nations Environment Programme — World Conservation Monitoring Centre in Cambridge. I am part of a team that is assessing the international wildlife trade to provide recommendations to national governments on its sustainability."

"At the same time, I am finishing the projects I started with CEED."

Recalling her time spent working at CEED in 2015, Dr Di Fonzo says, "I really liked how open everyone was to collaboration, within and across nodes, and their enthusiasm for new projects and opportunities. It was fantastic to work with, and learn from such brilliant people."

** Paper co-authors: Hugh Possingham, William Probert, Joseph R. Bennett, Liana Joseph, Ayesha Tulloch, Shaun O'Connor, Jodie Densem and Richard Maloney.*

# RESEARCH WORKSHOPS

CEED's highly interactive, collaborative and successful research workshops continued to build the knowledge base in environmental decision science in 2015. The workshops provide a unique opportunity for CEED researchers and international participants to collaborate on some of the challenging issues arising with their work. In 2015, CEED staged 21 workshops and a Bi-Annual Centre Conference. Below are some of the highlights from the year's activity.

| | WORKSHOP | DATE | LOCATION |
|---|---|---|---|
| 1 | The legal and institutional dimensions of biodiversity offsetting | 21–22 Jan | ANU |
| 2 | Optimisation Tools for Linear Infrastructure | 11–13 Feb | UQ |
| 3 | Connecting telemetry of highly mobile threatened species and spatial conservation decision science | 25–27 Feb | UQ |
| 4 | Understanding the role of communities, governance, incentives and sustainable use in combating wildlife crime | 1–3 Mar | South Africa |
| 5 | Advancing conservation planning in the Mediterranean sea | 8–10 Apr | UQ |
| 6 | Invertebrate conservation; from theory to practice and policy | 9–11 Jun | UWA |
| 7 | The Era of Big Data Hits Conservation Science | 15–19 Jun | UQ |
| 8 | Replacing ad hoc restoration decisions through a formal process for specifying restoration objectives: characterising risk aversion and indifference to multiple outcomes | 2–3 Jul | UQ |
| 9 | Causal inference in conservation: Developing a systematic analytical framework for evaluating the site-based effects of land management strategies: a workshop and a training event | 6–10 Jul | UQ |
| 10 | Towards a social-ecological system framework for conservation planning (during ICCB conference) | 1–2 Aug | Montpellier, France |
| 11 | Standardising the accounting of protected area management costs | 1–2 Aug | Montpellier, France |
| 12 | Ecosystems services, biodiversity and network theory: Optimising management with multiple objectives | 2–6 Aug | UQ |
| 13 | When conservation goes viral: Social science insights for catalyzing conservation (Workshop during ICCB) | 7–9 Aug | Montpellier, France |
| 14 | Ecosystem level evaluation of assisted migration: when is moving an ecosystem engineer a wise decision? | 10–13 Aug | UQ |
| 15 | How do social networks influence the long-term successes of voluntary environmental conservation programs? | 1–3 Sep | UQ |
| 16 | Strategies and impacts of different approaches to conservation messaging | 14–16 Sep | UQ |
| 17 | ARIES — Artificial Intelligence for Ecosystem Services: Exploring collaboration pathways to tackle environmental, social and economic issues | 29 Sep | UQ |
| 18 | Biodiversity offsetting: Early lessons, challenges and opportunities | 14–15 Oct | UWA |

| WORKSHOP | | DATE | LOCATION |
|---|---|---|---|
| 19 | Conflicting policies and commitments: understanding the outcomes and robustness of conservation and restoration initiative in Brazil | 26–30 Oct | Brazil |
| 20 | Using tracking data to define marine protected areas (MPAs) | 28 Oct | Cape Town Sth Africa |
| 21 | Development of prioritisation approach for U.S. Fish and Wildlife Service recovery planning | 14–15 Dec | UQ |

## HOW DO SOCIAL NETWORKS INFLUENCE THE LONG-TERM SUCCESSES OF VOLUNTARY ENVIRONMENTAL CONSERVATION PROGRAMS?

**Participants:** University of Queensland, University of Melbourne, James Cook University, University of Western Australia, RMIT, University of Tasmania, CSIRO, Stockholm Resilience Centre

**Output:** Papers on how social network analysis can be best used to inform practical recommendations for NRM

How can research on social networks be best applied to natural resource management? What is the connection between networks and conservation?

Social networks consist of people and the relationships and exchanges that tie these 'actors' together. How the network is organised and functions has been identified as a key determinant of participation and performance in environmental programs.

Discussions revealed the importance of considering the value of information obtained from social network analysis relative to the costs associated with data collection and the risks associated with poor response rates.

The workshop also explored theoretical assumptions relating to the position of the social network on the causal pathway: does the social network shape management effectiveness or is it that social processes shape the social network.

## USING TRACKING DATA TO DEFINE MARINE PROTECTED AREAS (MPAS)

**Participants:** 150 scientists, students and NGO members

**Outputs:** Continued collaborations between CEED, BirdLife International and the seabird conservation community to assist with conserving these global 'ocean sentinels'

Seabirds are arguably the most threatened group of birds on the planet and conservation scientists around the globe are working to understand how we can better protect them.

CEED and Birdlife International held a workshop, attended by approximately 150 people, on the use of tracking data to define MPAs as part of the 2nd World Seabird Conference in Cape Town, South Africa in October.

MPAs are one of the tools needed to reverse declines in seabird species. They can be effective in a number of ways such as protecting seabird prey and reducing bycatch mortality. The workshop provided an opportunity for researchers and conservationists working on seabird conservation to communicate seabird conservation priorities including ensuring data are readily available to support the global effort to design networks of MPAs.

Broader discussion, led by Dr Ben Lascelles from BirdLife International, illustrated the myriad challenges seabird ecologists face in bridging the gaps between science, policy and implementation.

## LEGAL AND INSTITUTIONAL DIMENSIONS OF BIODIVERSITY OFFSETTING

**Participants:** 15 academics and professionals from law, economics, business, ecology and policy

**Outputs:** Exploring biodiversity offsetting from multiple perspectives

Attendees came together to discuss biodiversity offsetting with a multi-disciplinary twist. The overall goal of the workshop was to look at biodiversity offsetting from a range of different perspectives, and to understand how such policies can effectively deliver positive environmental outcomes.

Biodiversity offsetting is an increasingly popular and used around the world to compensate for the environmental impacts of development activities. A lot of good research, including the work of researchers from CEED, has provided insights into how to best calculate the losses and gains of biodiversity that occur through development and offsetting activities. Although biodiversity offsetting policy has been in place for around 20 years in Australia and internationally, environmental outcomes being delivered by these policies in practice are poorly known.

*(L–R) Alan Key, Andrew Macintosh, Ben O'Hara, Megan Evans, Graeme Bartrim, Martine Maron, David Takacs, Rachel Walmsley, Anthea Coggan, James Trezise, Stuart Whitten. Present but not in photo: Karen Hussey, Jason Cummings, Miranda Lello.*

## CAUSAL INFERENCE IN CONSERVATION

**Participants:** 30 participants from CEED, CSIRO, University of British Colombia, University of Cambridge, Basque Centre for Climate Change and James Cook University

**Outputs:** Incorporation of methods into planning

How can we be confident that a conservation intervention had a positive impact? This was the central question at a recent workshop in causal inference, held at The University of Queensland in July.

We've all heard the adage that "correlation does not imply causation" — CEED researchers wanted to explore what does, so the Centre brought in an international expert on the topic, Paul Ferraro, Bloomberg Distinguished Professor at Johns Hopkins University, to train participants on the art (and science) of causal inference.

An advisor to the Global Environmental Facility (GEF) Paul has over a decade of experience in environmental policy evaluation, including vibrant contributions to both the peer reviewed literature and conservation practice.

Participants learned that to identify causal effects, we are really trying to eliminate rival explanations that may mimic or mask a relationship between a cause and an effect.

This consideration requires a greater attention to analysis design than is often given. It can have significant implications for interpreting the effectiveness of conservation actions.

For example, naively comparing deforestation rates inside and outside parks (and not considering that parks are usually biased towards areas of low conflict with other uses) may overestimate the effectiveness of protected areas in delivering avoided deforestation by over 65%. Lucky we now know about causal inference!

*Workshops provide a unique opportunity for CEED researchers and international participants to collaborate on challenging issues.*

## BIG DATA HITS CONSERVATION BIOLOGY

**Participants:** 30 researchers from University of Queensland, the University of Melbourne and Southern Denmark University

**Output:** Further development of the COMPADRE and COMADRE databases to allow for a better integration of demographic data with other open-access databases (such as BIEN, GBIF, IUCN, GeneBank) to address global questions in conservation science

Over 30 researchers came together to assess how big databases such as COMPADRE and COMADRE, among others, can be used to address pressing conservation questions in Australia and around the globe.

As a result, the group has published two journal articles that make a call for conservation scientists to use the large open-access ecological and evolutionary databases that have emerged in recent years. A further two manuscripts are in press for release in 2016. The first examines the possibility of using anatomic and physiological traits as shortcuts of demographic information to predict species invasions and extinctions. The second tests the ecological hypothesis that animal species' growth rates (extracted from COMADRE) are higher at the centre of their range, than on the edge. A workshop in Melbourne on Integral Projection Models (IPMs) will also be held in March 2016.

*Developing guidelines to enhance intervention cost accounting for conservation.*

## IMPROVING HOW THE COSTS OF BIODIVERSITY MANAGEMENT INTERVENTIONS ARE USED IN CONSERVATION SCIENCE

**Participants:** 21 participants from the University of Queensland, University of Cambridge, University of Helsinki, Bangor University, Monash University, Australian National University, James Cook University, University of Tennessee, Wildlife Conservation Society, The Nature Conservancy, Bush Heritage, Natural England and KNZ Wildlife

**Outputs:** Paper in preparation for submission to Conservation Biology; initiation of a collaborative group of researchers that work on this topic; a follow up workshop at SCBO in July 2016 to draft a set of best practices for management cost data collection that will be suggested for acceptance by the IUCN; an accepted student presentation on the standards for the World Parks Congress in September 2016, and; a presentation on the standards at the SCBO Conference in July 2016

Biodiversity conservation often depends on management actions that are as varied as fencing, weed control, or aerial surveillance. Such management actions are critical for biodiversity conservation yet can incur a large cost. An understanding of relative costs of conservation is critical for conservation decision-making (ie. Cost/benefit analyses) but, the lack of a standardised framework for cost accounting hinders the comparison of costs across studies and sites.

This workshop aimed to improve how data on intervention costs are collected and used to provide useful estimates of management costs for conservation science.

The workshop participants examined current practices and developed a set of guidelines to enhance intervention cost accounting for conservation planning. A draft paper was developed proposing recommendations for reporting and using intervention cost information that can be incorporated into editorial standards at the leading conservation journals. They include 1) what components of the budget should be considered as management costs, 2) why some components may be more important to consider than others, 3) how we can calculate and report costs to improve their application in conservation science.

# Researcher profile

## MY 2015: MS ESTI PALMA

**2015 was a busy year for CEED researcher Estibaliz Palma, as she delivered two major presentations and was awarded a grant from the Australian Wildlife Society.**

Drawn to the Australian landscape and the opportunity to work with leading researchers, Ms. Palma moved from Spain to Australia in 2013.

"I really enjoyed the spirit of collaboration I found here, so I considered Australia to be a great setting to undertake my Ph.D."

She is currently working in the field of functional ecology and community assembly — focusing on the ways invasive plant species behave in different environments.

"I am interested in the way weeds function, if we understand their traits and characteristics, we can predict how a new invasive species might behave. This gives us the ability to identify the biggest potential threats and hopefully, a chance to intervene."

Ms. Palma's achievements were recognized with a 2015 University Grant Award from the Australian Wildlife Society, for her research on invasive plant species in Victoria.

"I'm conducting this research under the supervision of Jane Catford and Peter Vesk, whom I would like to acknowledge as excellent mentors. We are looking at approximately 60 different invasive species, which span four major categories of invasion behaviour."

Ms. Palma has also conducted research into invasive plants in urban environments.

"I presented my findings on 'A global assessment of functional changes in urban plant communities' at EMAPI 2015 and the Ecological Society of Australia's Annual Meeting. This marked the culmination of one and a half years of work, looking at both invasive weeds and species extinctions in 11 major cities throughout North America, Asia and Oceania.

"Through our research we were able to identify the ways in which some plant species had responded to urbanisation."

Describing her experience as a CEED researcher, Ms Palma says,"I have nothing but beautiful words to describe my experience with CEED so far. I get the impression that every node consists of fantastic groups of people who are always willing to help out. I also really appreciate the personal and economic support I receive through the Centre.

"I'm taking every chance I can to travel around Australia and discover more amazing plants and animals!"

# STAKEHOLDER ENGAGEMENT

15
international plenaries

121
international presentations

10
national plenaries

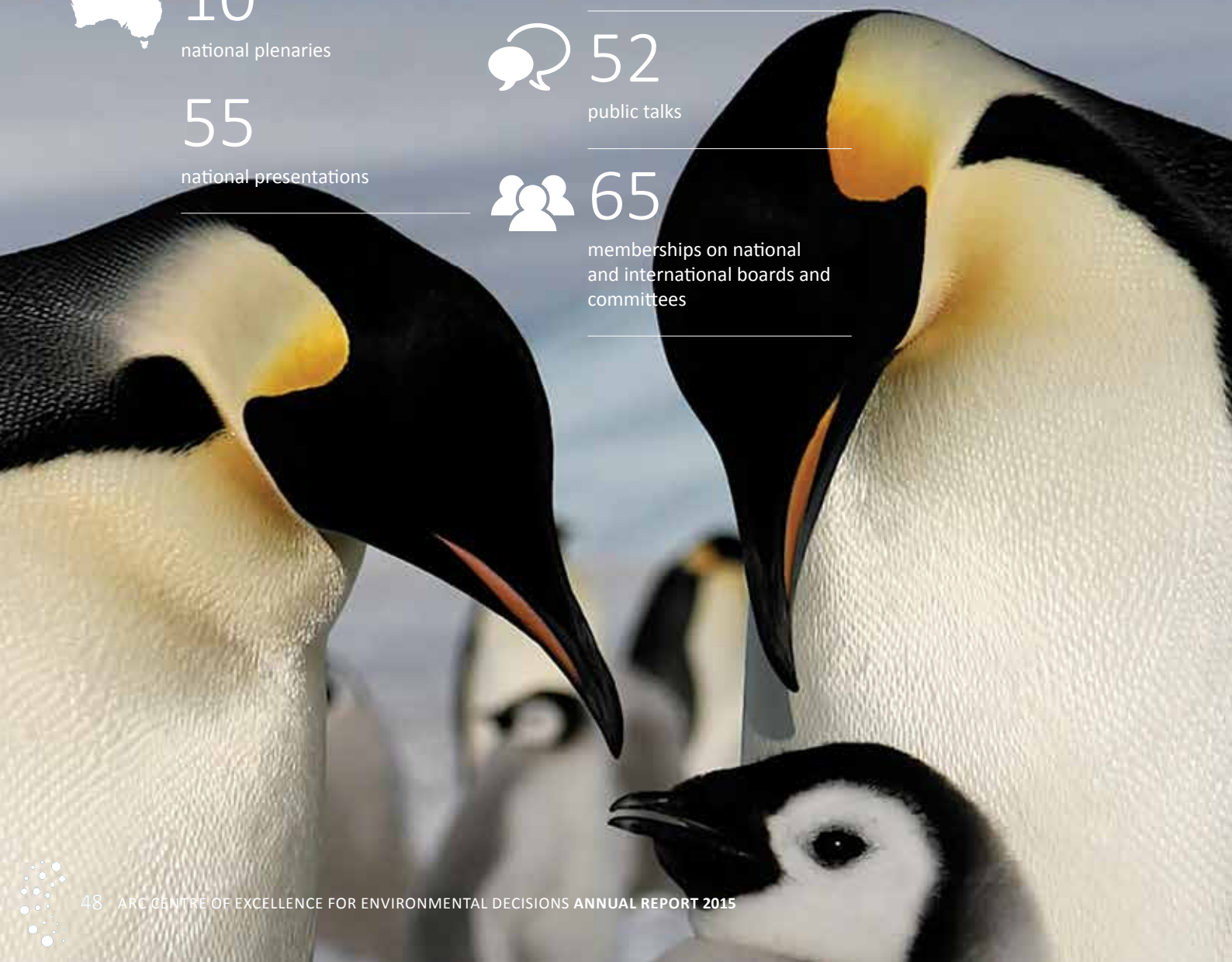
55
national presentations

183
government, industry and community briefings

45
submissions to government on policy-related matters

52
public talks

65
memberships on national and international boards and committees



## CEED works with a range of stakeholders including collaborating research organisations; federal, state and local governments and agencies; NGOs; international agencies; regional programs; and the private sector.

The work ranges from research, through to knowledge sharing and providing advice through specific briefings.

Throughout 2015 CEED has engaged across this broad group of stakeholders through a range of mechanisms including plenaries at international (15) and national (10) events. CEED researchers also delivered 121 international presentations and 55 national presentations. These events have included a diverse range of conferences and opportunities at international research institutions and universities including:

- The International Congress for Conservation Biology (ICCB) conference, Montpellier France
- The 16th Sede Boqer Symposium in Memory of Merav Ziv: Species Invasion and Range Expansion, Israel International Association for Vegetation Science (IAVS) Symposium, Brno Czech Republic
- AARES National Conference, Feb 2015, Rotorua, NZ
- Ecological Society of America Annual Meeting, Baltimore, USA
- Thinking Mountains Conference, Jasper, Canada
- International Association of Landscape Ecology World Congress, Portland, USA
- Centre for Environmental and Climate Research, Sweden
- IUCN Global Leader's Forum, Jeju, Korea
- World Seabird Conference, Capetown, South Africa
- Science for Parks, Parks for Science Conference, Berkley, USA
- Symposium, Academy of Science, Munich, Germany
- New Zealand Ecological Society Annual Conference, Christchurch, New Zealand
- National Conference of the Society of Australian Systematic Biologists, Freemantle, WA
- BES Symposium at the University of Sydney, Sydney,
- Australian Wildlife Management Society Annual Conference, Perth, WA
- Ecological Society of Australia Annual Conference, Adelaide, SA
- 21st International Congress on Modelling and Simulation (MODSIM2015), Broadbeach, QLD
- ANZIF 2015 Conference (Australia and New Zealand Institute of Foresters), Creswick

Further to the international and national conference and events, the CEED researchers have been very active in other stakeholder outreach and engagement opportunities with 183 government, industry and community briefings taking place over the past 12 months, and 52 public talks.

CEED researchers continue to be at the forefront of policy and on-ground management discussions and highly regarded for their expertise on a range of matters, as evidenced by the 45 submissions to government on policy related matters in 2015, and memberships on 65 national and international boards and committees.

Our senior researchers are particularly involved with our stakeholders. As an example, our Centre Director Prof Hugh Possingham (UQ) sharing CEED's research and the learnings of CEED's environmental decision science. In Australia he has engaged closely with the Commonwealth Department of the Environment; the Threatened Species Commissioner; the Queensland Minister for Environment and Heritage Protection and the Minister for National Parks and the Great Barrier Reef; the NRM Board of South Australian (SA) Government; the Conservation Council of SA; the SA Department of Environment, Water and Natural Resources; the Department of Parks and Wildlife, Western Australia; WWF Australia; NSW Fisheries; SEQ Catchments; NSW Minister for the Environment, Minister for Heritage, and Assistant Minister for Planning and the NSW Independent Biodiversity Reforms Panel; and gave a range of public talks. Internationally, Prof Possingham worked with a number of collaborating organisations including Imperial College London; the World Bank/Global Environment Facility Capturing Coral Reef and Related Ecosystem Services (CCRES) project; the University of British Columbia; and Leibniz Centre of Tropical Marine Ecology.

Several other examples of our researchers making significant contributions to stakeholder issues include:

- Dr Graeme Doole and Prof David Pannell (UWA) have continued to provide expert advice to the New Zealand governments and stakeholder groups on a variety of matters relating to water policy including meeting with the Waikato River Authority (Hamilton) to discuss prioritisation of their investments in water pollution mitigation, and working with the Waikato Regional Council Healthy Rivers Collaborative Stakeholder Group regarding the evaluation of policies to improve water quality.

  Other discussions have included the training of members of Dairy New Zealand on the adoption of new conservation practices; working with the Ministry of Environment on prioritisation of environmental practices; presenting to the Lake Rotorua Stakeholder Group on economic evaluation of alternative programs for rights to leach nitrogen.

- Prof David Pannell (UWA) was active in engaging the Federal government on post 2020 targets for greenhouse gas emissions following presentations at the Ministerial Round Table on this issue.

- Dr Duan Biggs (UQ) is leading the global discussions on the role of local communities in combatting the worldwide poaching crisis and illegal wildlife trade. Duan was involved in key discussions with scientists and conservation managers at a Symposium on the role of communities, governance, incentives and sustainable use in combating wildlife crime held in South Africa.

- Ms Laura Mumaw (RMIT) has been meeting with various greater Melbourne municipal councils to consider development of a regional framework for wildlife gardening.

- Drs Michael Burton and Marit Kragt (UWA) presented and discussed the use of Discrete Choice Modelling to estimate values for the Kimberley Coast with WA Department of Parks and Wildlife and WA Marine Science Institute.

- Dr Marit Kragt (UWA) is working with the Bureau of Meteorology, Perth, discussing the valuation of new radar technology investments in the WA Wheatbelt.

- Mr Eduardo Gallo Cajiao (UQ) presented on "The Development of International Efforts for Conserving Migratory Shorebirds in the Asia-Pacific" to Birding NSW in October to about 50 attendees. The take home message was that citizen science-based monitoring does make a difference in influencing conservation policy.

- Associate Prof Kerrie Wilson and PhD student Ms Courtney Morgans (UQ) were invited to attend the UNEP Great Ape Survival Partnership (GRASP) South East Asia regional meeting in Kota Kinabalu, Malaysia in August. Participants discussed current threats to the remaining populations of orangutan such as agricultural expansion, hunting and the illegal wildlife trade. Courtney presented preliminary findings of her PhD research on the nature of collaborative relationships between conservation organisations and across sectors.

- Ms Louise Blackmore (UWA) presented at a number of conferences including on: "Collaborative Co-Production of Carbon and Biodiversity" at the 2015 Australian Agricultural and Resource Economics Conference in Rotorua, New Zealand, and to some 300 high school-students at the Science Cafe event at UWA in August (www.scitech.org.au/business-centre/news/1768-science-cafe-2015). Louise also visited the Kimberley Region of WA as part of the Travelling Scientist Program (http://spice.wa.edu.au/spice-initiatives/travelling-scientist-program/) in April talking to high-school students about tertiary studies and careers in science, and her own research.

- Ms Fleur Maseyk (UQ) working with Hugh Possingham, Martine Maron and Guy Dutson (The Biodiversity Consultancy) and others in The Catalyst Group have developed an accounting model to evaluate biodiversity offset proposals for the NZ Department of Conservation. The model and user manual is publicly available on the DOC website (www.doc.govt.nz). Peer reviewed publications are currently in review.

# BUILDING CAPACITY

CEED is involved in training at many levels — for our own researchers and collaborators as well as practitioners. The extensive training and mentoring program is part of the CEED's ongoing commitment to early career researchers and managers in building knowledge and skills in all aspects of environmental decision-making.

Examples this year in building capacity, many including early career researchers, include training on gender equity issues, practical training in how to use Marxan software, as well as leadership and media training for our early career researchers.

## LIFTING THE LID ON UNCONSCIOUS BIAS AND GENDER EQUITY

**Participants:** 80 people from across ANU, federal government departments and streamed live to audiences on-line

Unconscious bias is the lens through which we interpret what we hear and what we see, and informs how we think about ourselves and others. Even those who consciously support gender equality can be unconsciously biased in their behaviours, speech or decisions.

The event, organised as part of the CEED Leadership Program, highlighted that the most significant barrier to full, equal contribution, participation and progression of women in corporate life and science is unconscious bias.

Keynote speaker, Deborah May emphasised that it is possible to tackle unconscious bias by being mindful of our own biases, paying attention to how we are viewing, judging and assessing, and correcting our actions and behaviours. Other actions which can be taken to address or counteract bias include speaking up about inappropriate comments or behaviours that perpetuate bias and providing career development, mentoring, coaching and sponsorship opportunities for women.

*Our extensive training and mentoring program is part of the CEED's ongoing commitment to early career researchers and managers.*

## MARXAN GOES TO BARCELONA

**Participants:** Postgraduate students, postdoctoral researchers, conservation practitioners and academics from France, Italy, Spain, Ecuador and South Africa.

**Outputs:** The introductory Marxan workshop to build capacity for environmental decision-making in all of these countries

For the first time in Barcelona, the Marxan team held a five-day course to provide the participants with the knowledge necessary to use Marxan, as well as advanced skills in applying systematic conservation-planning software to solve different kinds of conservation problems.

The course in Spain is part of an ongoing program of Marxan introductions that has seen the international community of Marxan-users blossom. Over 7000 environmental professionals in more than 180 countries are regularly using Marxan — a tool originally developed by some of our CEED researchers. Its application has influenced how humans manage around 5% of the Earth's surface.

The course allowed participants a first-ever glimpse of exciting new ways to incorporate uncertainty in data or threats into decisions using 'Marxan with Probability'.

In addition to forming valuable new collaborations between CEED and academics from around the world, workshop participants went away with a broad suite of tools for addressing different types of planning problems, and a new passion for more effective environmental decision-making.

The course was designed and run by Ms Vivitskaia Tulloch (UQ) and Dr Ayesha Tulloch (ANU), and supported by Transmitting Science (www.transmittingscience.org), a Spanish science education company established to improve the science capacity of the region.

## MAKING HEADLINES — THE RIGHT ONES!

In December at the CEED conference, Currie Communications trained over 40 early career researchers in Media 101. The objectives were to build up skills, confidence and performance; to equip researchers to better explain their work; and to help them get the CEED message out.

Participants learned what makes news, the importance of key messages, how to prepare for a media interview, and tips and tricks for a good media performance.

A series of group exercises provided the opportunity to put the theory into practice. Mock interviews highlighted common issues — use of jargon and a tendency to wander from the message.

Pre-and post-session surveys revealed that participants' confidence improved as a result of the training.

## CONTRIBUTING TO BIODIVERSITY PROTECTION AND FOREST RESTORATION POLICY IN BRAZIL

In November 2015, Morena Mills (UQ), Hawthorne Beyer (UQ), Jonathan Rhodes (UQ), Ascelin Gordon (RMIT), Jennifer McGowan (UQ) and Hugh Possingham (UQ) travelled to Brazil to work on three policy-focussed workshops and run a Marxan training course. During this time they collaborated on research papers with over 50 Brazilian and international researchers, travelled to four different cities and helped with the development of numerous PhD projects, of those attending the course.

The first workshop focussed on the Recovery Plan of Jaguars within the Atlantic Forest in collaboration with Katia Ferraz from ESALQ, part of the University of Sao Paulo and Rogerio Cunha from CENAP, the government body responsible for the recovery plans of Brazilian threatened species and several others. Jaguars are a keystone species within the Atlantic Forest, one of the most biodiverse and endangered forests in the world. Together we are developing an approach to prioritise enforcement and actions that encourage compliance with the existing legislation. The population of jaguars within the remaining Atlantic Forest patches is extremely low and thus the protection of every jaguar against hunting pressures is critical.

The second workshop focussed on prioritisation of restoration of the Atlantic Forest. Only around 11.7% of the original extent of the Atlantic Forest remains standing, with only about 2.5% of the original extent being fully protected. The remaining forest fragments of the Atlantic Forest are embedded in a mosaic of agricultural and urban areas. The Brazilian government committed to recovering substantial areas of this forest, but priority maps are required to identify where restoration can be most cost effective. Our researchers are thus part of a working group with representatives from the International Institute for Sustainability (IIS), the University of Sao Paulo, the Brazilian herbarium, government, other academics and NGO's, who are developing a priority forest restoration map. Our researchers will also be involved in assisting with the implementation of the National Plan for the Recovery of Native Vegetation (PLANAVEG) in Brazil.

The third workshop focussed on the Brazilian government's biodiversity-offset policy that is being developed. For example, Brazil's forest protection laws required the development of biodiversity offsets, traded amongst landholders to, in theory, ensure no net loss of biodiversity. The development of biodiversity offsets however is tricky as details in policy formulation and application can, in practice, result in large biodiversity losses. During this workshop, CEED researchers worked with researchers in Brazilian, French and Argentinian institutions on methods that improve current policy.

There are many important conservation opportunities in Brazil that can be usefully informed through collaborations between CEED and the outstanding Brazilian institutions we engaged with on the trip.

# OUR LEGACY — WORKING WITH EARLY CAREER RESEARCHERS

## Working with our early career researchers to build their capacity to be leaders in the next generation of conservation scientists is a priority for CEED.

The Centre is home to 55 postdoctoral researchers, 77 PhD scholars and seven Masters and three Honours students working on research directly funded by the Centre or associated with the Centre's research through other projects.

Our early career researchers have been having an impact on the world stage with many participating in the premier conservation congress of the year — the International Congress for Conservation Biology (or ICCB). In 2015 the 27th ICCB was held during August in Montpellier, France, and several of CEED's early career researchers participated in a leadership session.

During the year, Dr Vanessa Adams and Mr Sugeng Budiharta from UQ were selected as Young Fellows of the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES). The program aims to harness the finest emerging talent in the international effort to save biodiversity, and building capability for the future.

Ms Fleur Maseyk, a PhD scholar at UQ, has been involved in the development of an accounting model to evaluate biodiversity offset proposals for the NZ Department of Conservation. She is also working with AgResearch and supported by the Taranaki Regional Council (NZ), on investigating farmer perspectives on the ecosystem services provided by riparian margin plantings.

The CEED PhD Top-Up Scholarship scheme and the Early Career Travel scheme continued in 2015 and benefitted 22 early career researchers. The scheme continues to provide support to early career researchers and build a strong research legacy for the Centre.

The CEED Environmental Leadership program, launched in November 2014, continued its 10-month program of intensive training, capacity building exercises, topic-specific modules on leadership, and interactions with experts in the science fields.

The leadership cohort comprised 15 PhD students and postdoctoral fellows. An important component of the program was the development of an individual leadership action plan that each participant implemented over the course of the program. As part of that plan, participants undertook a personal or collective project, and many worked with mentors who helped them address goals in their plan.

CEED provided funding not only for the leadership program, but also for early career researchers at nodes to design and host an event related to leadership skill development. The result was Conflict Resolution skills at (UQ); a Structured Decision-Making workshop (UM); and Gender Equity in the Sciences (ANU).

Opportunities for collective learning were also developed, including the CEED Early Career Leaders Blog (http://ceedleaders.weebly.com/). The blog has provided a forum for members to post reflections on their learning over the course of the year.

The Centre has also provided further opportunities for our young researchers including support to attend the Student Conference on Conservation Science (SCCS) Conference in January, and participating in the development of a Science-Art show.

*"If some people are indeed born leaders, others are made"*

— Ramona Maggini, CEED Leadership Program blog

# Cultivating the region's next generation of conservation scientists

**Conservation science students in Australia have access to some of the world's finest conservation researchers and facilities but the same cannot be said for students working elsewhere in our region.**

CEED has made many concerted efforts to develop the next generation of conservation scientists in both Australia and in the Asia-Pacific region, and in 2015 supported the second Student Conference on Conservation Science (SCCS) at the University of Queensland in 2015.

The conference brought together around 150 research students for an intensive week of talks, training workshops and field trips. There was also considerable emphasis on communication and network building in the hope that contacts made during the conference would lead to enduring relationships as the students develop into conservation researchers and practitioners.

Twenty-four fully paid scholarships were offered to early career researchers, covering all transport, accommodation, conference registration, social activities and excursions. Scholarship holders were from 15 different countries.

Many of the countries in the region have limited capacity to do the conservation research needed. The conference included training in ecology, conservation, GIS, communication, and conservation economics, which are otherwise rarely available within the region The SCCS is one small action CEED can take to help redress this situation. It is hoped that in 2018 the Conference will again be held in Brisbane.

*Bringing together research students from around the region.*

## 2015 PHD SCHOLARS

| STUDENT | UNIVERSITY | COUNTRY OF ORIGIN | THESIS TITLE | SUPERVISORS |
|---|---|---|---|---|
| Christopher Baker | UM | Australia | Optimising invasive species management | *Michael Bode, Michael McCarthy, Steve Carnie* |
| Payal Bal | UQ | India | Biodiversity indices for monitoring and managing ecosystems | *Jonathan Rhodes, Eve McDonald-Madden, Ayesha Tulloch* |
| Sana Bau | UM | New Zealand | Reconciling value judgements and evidence-based decision making theory in conservation | *Michael McCarthy, Terry Walshe* |
| Richard Beggs | ANU | Australia | Impact of noisy miner removal from small fragment of native vegetation on presence and behaviour of small passerines | *David Lindenmayer, Jennifer Pierson, Ayesha Tulloch* |
| Donna Belder | ANU | Australia | Survival and persistence of woodland birds in restoration plantings | *David Lindenmayer, Jennifer Pierson, Karen Ikin* |
| Laurence Berry | ANU | Australia | The ecology of fire refugia in the Victorian Central Highlands | *David Lindenmayer, Sam Banks, Don Driscoll* |
| Louise Blackmore | UWA | Australia | Collaborative conservation: getting landholders to work together to achieve biodiversity outcomes | *Steven Schilizzi, Sayed Iftekhar, Marit Kragt, Kerrie Wilson, Abbie Rogers* |
| Sugeng Budiharta | UQ | Indonesia | Systematic planning for the rehabilitation of degraded tropical forests: Scenarios for optimum allocation of REDD+ in Indonesia | *Kerrie Wilson, Hugh Possingham, Peter Erskine, Erik Meijaard* |
| Abbey Camaclang | UQ | Canada | Critical habitat definition and identification for threatened and endangered species | *Hugh Possingham, Tara Martin, Martine Maron* |
| Stefano Canessa (submitted May 2015) | UM | Italy | Using decision theory to improve the management of reintroductions in conservation biology | *Kirsten Parris* |
| Xyomara Carretero-Pinzón | UQ | Colombia | Conservation Planning of primates in rapidly transformed landscapes | *Jonathan Rhodes, Thomas Defler, Clive McAlpine* |
| Colleen Corrigan | UQ | USA | Biophysical and social measures of conservation effectiveness linking local to global scales | *Marc Hockings, Catherine Robinson, Stephen Garnett, Hugh Possingham* |
| Katrina Davis | UWA | Australia | Economic benefits and costs of spatial marine management | *David Pannell, Marit Kragt and Steven Schilizzi* |
| Kiran Dhanjal-Adams | UQ | United Kingdom | Conserving migratory birds | *Richard Fuller, Karen Mustin, Hugh Possingham* |
| John Evans | ANU | Australia | The long-term and large-scale effects of the establishment of an exotic planation on species of native forest beetles and butterflies | *Sam Banks, Don Driscoll, K Davies* |
| Dini Fardila | UM | Indonesia | Relating landscape metrics to ecological processes for spatial planning and management of birds in fragmented habitat | *Michael McCarthy, Luke Kelly* |
| Claire Foster | ANU | Australia | Ecological impacts of highly abundant macropods | *David Lindenmayer, Phil Barton, Chloe Sato* |

## 2015 PHD SCHOLARS *continued...*

| STUDENT | UNIVERSITY | COUNTRY OF ORIGIN | THESIS TITLE | SUPERVISORS |
|---|---|---|---|---|
| Hannah Fraser | UM | Australia | Of woodlands and birds: how terminology effects our inferences | *Michael McCarthy, Cindy Hauser, Libby Rumpff, Georgia Garrard* |
| Eduardo Gallo-Cajiao | UQ | Colombia | How effective is the international regime for the conservation of migratory shorebirds in the East Asian Australasian flyway | *Richard Fuller, Salit Kark, Tiffany Morrison* |
| Katherine Giljohann | UM | Australia | Optimal fire management for biodiversity conservation in fire-prone landscapes | *Michael McCarthy, Tracey Regan* |
| Angela Guerrero Gonzalez | UQ | Colombia | Accounting for the links between social and ecological systems for effective nature conservation | *Kerrie Wilson, Ryan McAllister, Jonathan Corcoran* |
| Yi Han | UQ | China | Modelling the effects of invasive species eradication on other interacting species in an ecosystem context | *Eve McDonald-Madden, Yvonne Buckley, Justine Shaw, Hugh Possingham* |
| Nicole Hansen | ANU | Australia | Movement of reptiles through fragmented agricultural landscapes | *David Lindenmayer, Damian Michael, Don Driscoll, Milton Lewis* |
| Mat Hardy | RMIT | Australia | The use of decision theoretic approaches to improve private land conservation | *Sarah Bekessy, Ascelin Gordon, James Fitzsimons* |
| Brett Howland | ANU | Australia | Managing kangaroo grazing in the conservation of grassland and grassy woodland fauna | *David Lindenmayer, Adrian Manning* |
| David Johnson | ANU | Australia | Restoring floristic diversity of the ground layer in modified ecosystems | *Phil Gibbons, Don Driscoll, Jane Catford* |
| Geoffrey Murray Kay | ANU | Australia | Conserving endangered ecosystems through Environmental Stewardship | *David Lindenmayer, Blanchard, Don Driscoll, Saul Cunningham* |
| Claire Keely | UM | Australia | Conservation genetics of the growling grass frog in an urbanising landscape | *Kirsten Parris, Geoff Heard* |
| Alex Kusmanoff | RMIT | Australia | How message framing influences environmental decisions | *Sarah Bekessy, Ascelin Gordon, Fiona Fidler* |
| Juliana Lazzari | ANU | Australia | The interaction of fire and fragmentation: can fire in fragmented landscapes cause regional declines of fire-specialist (reptile) species | *Geoff Cary, David Lindenmayer, Don Driscoll* |
| Darren Le Roux | ANU | South Africa | Maintaining and perpetuating resources associated with mature trees for wildlife in modified landscapes | *Phil Gibbons, Adrian Manning, David Lindenmayer, Karen Ikin* |
| Maria Martinez-Harms | UQ | Chile | Conservation planning for ecosystem services in the system of natural protected areas of Chile | *Kerrie Wilson, Brett Bryan, Jonathan Rhodes, Hugh Possingham* |
| Fleur Maseyk | UQ | New Zealand | Applying the ecosystem services concept to natural resource management and conservation decision making | *Hugh Possingham, Alec Mackay, Yvonne Buckley, Marit Kragt* |

## 2015 PHD SCHOLARS *continued...*

| STUDENT | UNIVERSITY | COUNTRY OF ORIGIN | THESIS TITLE | SUPERVISORS |
|---|---|---|---|---|
| Sean Maxwell | UQ | Australia | Ecological, social and economic factors for conservation decision making: what should we learn about and when | *James Watson, Jonathan Rhodes, Eve McDonald-Madden* |
| Jennifer McGowan | UQ | USA | Methods in marine spatial prioritisation | *Hugh Possingham, Carissa Klein, Maria Beger* |
| Kimberley Millers (submitted Feb 2015) | UM | Australia | Searching for the stars: assessing the monitoring and management of the invasive seastar, *Asterias amurensis* in Victoria (Australia) | *Michael McCarthy, Jan Carey* |
| Courtney Morgans | UQ | Australia | Population level modelling of orangutans in East Kalimantan and the evaluation of strategies for their protection | *Kerrie Wilson* |
| Will Morris | UM | Australia | The value of information for vegetation management | *Peter Vesk* |
| Laura Mumaw | RMIT | Australia | Biodiversity decision making and stewardship in urban neighbourhoods | *Sarah Bekessy, Cecily Maller* |
| Will Neal (unitl Oct 2015) | UM | Australia | Assessing the value of phylogenetic data for conservation planning | *Peter Vesk, Heini Kujala, Laura Pollock* |
| Thayse Nery De Figueiredo | UWA | Brazil | Optimal land-use change to increase water quality, quantity and biodiversity outcomes | *Morteza Chalak, Ben White, Rohan Sandler, Maksym Polyakov* |
| Katherina Ng | ANU | Australia | Movement of ground arthropods in fragmented agricultural landscapes | *David Lindenmayer, Don Driscoll, Milton Lewis* |
| Christy Nguyen | UWA | Vietnam | Factors influencing calculation of capacity value of wind power: a case study of the Australian National Electricity Market | *Morteza Chalak. Atakelty Hailu, Chubo Ma* |
| Estibaliz Palma | UM | Spain | Plant invasion ecology: seeking for generalisation through species traits | *Jane Catford, Peter Vesk* |
| Michaela Plein | UM | Germany | Assessing and managing interacting species at risk of coextinction | *Peter Vesk, Melinda Moir, Michael Bode, Michael McCarthy* |
| Tal Polak | UQ | Israel | Conservation decision science | *Hugh Possingham* |
| Stephanie Pulsford | ANU | Australia | Exploring methods for improving connectivity of terrestrial native fauna in South East Australian grazing landscapes | *David Lindenmayer, Don Driscoll, Alessio Mortelliti* |
| Keren Raiter | UWA | Australia | Mitigating mining's enigmatic ecological impacts in Australia's Great Western Woodlands | *Richard Hobbs, Hugh Possingham, Suzanne Prober, Leonie Valentine* |
| Andrew Rogers | UQ | USA | Avian community response to invasion by non native species | *Salit Kark, Berndt Van Rensburg* |
| Gerard Ryan | UM | Australia | Birds in the Sky, Fish in the Sea, Money in the Bank: Quantitative methods for more effective conservation | *Michael McCarthy, Emily Nicholson* |

## 2015 PHD SCHOLARS *continued...*

| STUDENT | UNIVERSITY | COUNTRY OF ORIGIN | THESIS TITLE | SUPERVISORS |
|---|---|---|---|---|
| Matthew Selinske | RMIT | USA | Predicting human behaviour for better environmental policy decision making | *Sarah Bekessy* |
| Darren Southwell | UM | Australia | Optimal management of populations across space and time | *Michael McCarthy, Brendan Wintle, Eve McDonald-Madden* |
| Ingrid Stirnemann | ANU | New Zealand | Habitat heterogeneity: how it is generated and drives spatial patterns in mammals and birds | *David Lindenmayer, Wade Blanchard, Phil Gibbons* |
| Freya Thomas | UM | Australia | The generation and generalisation of plant functional traits in fire-prone communities | *Peter Vesk* |
| Nooshin Torabi | RMIT | Australia | Understanding landholder participation in biodiverse carbon plantings | *Sarah Bekessy and Kathryn Hegarty* |
| Vivitskaia Tulloch | UQ | Australia | Managing threats to land and sea ecosystems to balance multiple objectives | *Hugh Possingham, Anthony Richardson, Chris Brown, Carissa Klein, Eva Plaganyi* |
| Els Van Burm | UM | Belgium | Optimal monitoring for environmental management | *Michael McCarthy, Gurutzeta Guillera-Arroita, Brendan Wintle* |
| Ruben Venegas Li | UQ | Costa Rica | Effectiveness of transboundary collaboration in systematic and spatial marine conservation planning and prioritisation in the Coral Triangle and at global scales | *Salit Kark* |
| Nelida Villasenor | ANU | Chile | Biodiversity conservation in urbanising forested landscapes | *David Lindenmayer, Don Driscoll, Phil Gibbons* |
| Casey Visintin | UM | USA | Wildlife collisions with linear infrastructure: Modelling, management and mitigation | *Michael McCarthy, Rodney van der Ree (ARCUE)* |
| Matt West | UM | Australia | Evaluating the response of frogs to multiple threats | *Michael McCarthy* |
| Michael Wysong | UWA | USA | Understanding the mechanisms between feral cat and wild dog interactions in the arid rangelands of Western Australia | *Richard Hobbs, Leonie Valentine, Neil Burrows, Euan Ritchie* |
| Ding Li Yong | ANU | Singapore | Cross-taxonomic surrogates of biodiversity in a woodland setting in Australia | *David Lindenmayer, Phil Barton, Saul Cunningham* |
| Johanna Zimmerhackel | UWA | Germany | Interactions of diving tourism and fisheries in marine protected areas: market values and new approaches to deter illegal fishing in the Maldives Shark Sanctuary | *David Pannell, Mark Meekan, Marit Kragt, Abbie Rogers* |

# Researcher profile

## MY 2015: DR KATRINA DAVIS

**In 2015 Dr Katrina Davis made the move from Western Australia to begin her post-doctoral studies with CEED at the University of Queensland. "I chose to join CEED because I consider the Centre a world leader in conservation and decision science. I have worked with CEED researchers in the past and remain enthusiastic about future collaboration," says Dr Davis.**

"Of course, there's also this lovely humid weather," she says, with a mischievous laugh.

Dr Davis published her second CEED PhD paper last year, which focused on the behaviours of fishers, poachers and government authorities in Chile.

"We surveyed stakeholders in the coastal regions near Santiago, where fishing for shellfish is regulated according to a program called Territorial User Rights for Fisheries (TURF).

"Many fishers aren't enforcing their rights under this program, despite being aware of the associated benefits such as increased marine abundance, less time required to make catches and higher levels of productivity and profitability.

"We conducted a survey, using novel methodology to explore the issues at stake. We found the majority of rights-holders saw little benefit in monitoring for poachers. "

When fishers report poaching to government agencies, the response from the navy is often underwhelming, giving fishers the impression that it is not a priority for the government. In cases where poachers are detained, the penalties are not deemed severe enough to act as a deterrent.

Sustaining her focus on Chilean fisheries in 2015, Dr Davis entered a new collaboration with Dr Andres Ospina from the Estación Costera de Investigaciones Marinas.

"We are working with connectivity models that reconcile larvae movement in the water, to assist decision-making by coastal managers. This project aims to answer questions about the optimal locations for marine protected areas as well as to identify the best locations fishing activities."

Dr Davis was also responsible for coordinating a symposium on spatial economics at the Australian Agricultural and Resource Economics Society Annual Conference in Rotorua, New Zealand. There she presented her findings from Chile, as well as an additional paper entitled 'Spatial economics of marine management.' The symposium attracted several speakers in the field of resource economics, who have developed models and analysis that can account for heterogeneity (diversity) in the management of land and sea resources.

Dr Davis explains, "Basically by looking at our activities on a landscape scale, we can observe that certain areas will be better suited to certain uses. If we acknowledge the heterogeneity of the landscape, we can make better use of our natural resources."

Dr Davis looks forward to making the most of her time at CEED.

"It's a very dynamic environment and I find myself surrounded by talented and hard-working people, concentrated in a very close space — it's very inspiring!"

# COMMUNICATION AND OUTREACH

The Centre's communication efforts have picked up substantially during the year. A communications strategy was developed with the goal of benefitting environmental science, policy and management worldwide by sharing CEED's knowledge to solve complex problems of environmental management and monitoring.

Objectives focus on management and policy impact, effective products, effective engagement and a strong CEED culture.

Key activities this year included media relations, developing advisory briefs, building the profile of researchers, social media, the CEED conference and online communications.

## MEDIA RELATIONS

CEED has been prominent in the media with 19 media stories developed and released during 2015. The topics have been very diverse and include:

1. Scientists propose polar protection plan (Dr Joseph Bennett (Carleton University Canada) & Dr Justine Shaw (UQ & AAD))
2. Wildlife friendly cities will make us happier and healthier (Dr Karen Ikin (ANU))
3. New study tackles conflicting goals in the Coral Triangle (Dr Maria Beger (UQ))
4. CEED director named Eureka Prize finalist (Prof Hugh Possingham (UQ))
5. Frog wars: survivors emerge in war with killer fungus (Dr Ben Scheele (ANU))
6. New way to save fish… and fishers! (Dr Katrina Davis (UWA))
7. Celebrity species 'can help to save other wildlife' (Dr Joseph Bennett (Carleston University, Canada) & Prof Hugh Possingham (UQ))
8. How smart roads can help koalas beat traffic (Assoc. Prof Jonathon Rhodes (UQ))
9. Collaboration can save forests and $billions (Ms Rebecca Runting (UQ))
10. 'One tonne test' can help restore the world's failing coral reefs (Dr Joseph (Maina) Mbui (UQ))
11. Trophy hunting may be a key to saving wildlife (Dr Duan Biggs (UQ))
12. Targeting threats alone won't save our wildlife (Mrs Vivitskaia Tulloch (UQ) and Dr Ayesha Tulloch (ANU))
13. Being smart about SMART environmental targets (Mr Sean Maxwell (UQ))
14. Local communities 'have a key role' in the war on wildlife poachers (CEED, IUCN, IIED)
15. Vanishing big trees puts Australia's urban wildlife in peril (Mr Darren Le Roux (ANU))
16. Australian cities critical for threatened wildlife (Dr Pia Lentini (UM), Chris Ives (RMIT))
17. Bush up in the back paddock adds value to farm (Dr Maksym Polyakov and Prof David Pannell (UWA))
18. Major shortfalls identified in marine conservation (Dr Carissa Klein (UQ))
19. World failing to protect its migratory birds (Dr Claire Runge (UQ))

The two biggest stories were "Major shortfalls identified in marine conservation" and "World failing to protect its migratory birds" both of which generated over 100 articles online as well as print and radio coverage. The spread of our media coverage across different mediums can be seen below. Our potential audience reach was 7,344,183 for print, online and broadcast (iSentia). All stories were promoted to CEED's networks through our social media channels including Twitter and Facebook.

Summary of media coverage by media type

| MEDIA ARTICLES (INCLUDING SYNDICATED REPORTS): | |
|---|---|
| Magazines | 11 |
| Newspapers | 34 |
| Online news | 985 |
| Radio | 852 |
| TV | 56 |

## ONLINE COMMUNICATIONS

CEED's online presence strengthened during the year with a stronger focus on social media. We more than doubled our Twitter followers to over 1000 which represents a strong network of researchers, agencies, NGOs and other interested users. We had 109,000 impressions (see Figure 3) — the number of times the tweet is seen; almost 2000 engagements (see Figure 4) — clicks and retweets; and our Klout score is almost 50. Activity peaked at the ICCB Conference in September.

Facebook, with 758 'likes', continues as a means of connecting with the younger research community. With an even split of male and female users, our average reach is 366 users with 18 clicks and 11 likes, comments or shares per post. Our most popular post was about Centre Director Prof Hugh Possingham being awarded an honorary doctorate at UBC in November.

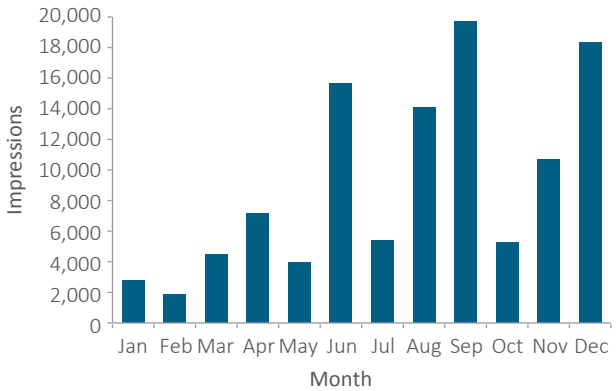



FIGURE 3 CEED Twitter impressions 2015

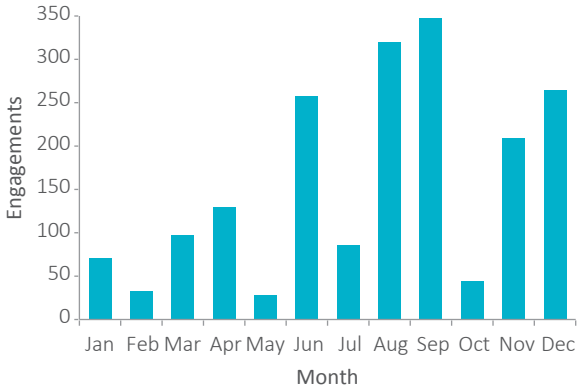



FIGURE 4 CEED Twitter engagement 2015

CEED researchers have also been active on blogs to ensure information is circulated to all audiences and this has proved to be a successful strategy. For example, Prof David Pannell's blog 'David Panell Discussions' received approximately 18,000 hits in 2015.

In 2015, the CEED website incorporated a number of new elements to improve our internal and external communication. These include a detailed conference calendar; an increased social media presence through the display of twitter feeds; and new resources including Decision Briefs.

The website is updated regularly, and has had 72 news articles posted to the site throughout 2015. The website also provides access to over 1000 scientific publications, including abstract details and online links. These were updated weekly throughout 2015.

The website will be revamped in 2016, to update both the design and technical features.

This year we placed a strong emphasis on fresh content on the news and activities of our researchers. The total number of hits, including the *Decision Point* website was 139,306 against our KPI target of 50,000. Our most popular pages this year were the leadership program, annual reports, and the list of presentations at ICCB.

## *DECISION POINT* MAGAZINE

Nine editions of *Decision Point* were published during the year, plus a special Spanish edition. With over 6000 subscribers, *Decision Point* aims to connect conservation policy makers, researchers and practitioners. *Decision Point's* audience covers a wide spectrum from universities and research institutions, government agencies, and the private sector (see Figure 5).

In February a new online version of *Decision Point* was launched with a dedicated URL **www.decision-point.com.au**. It received just over 60,000 hits during the year with the most popular stories being:

| | |
|---|---|
| May-15 | Why academics should communicate failure |
| Nov-15 | 'Bias' and natural resource management |
| Mar-15 | Perversity in the pasture |
| Jun-15 | Citizen science and conservation |
| Jun-15 | Why publish research? |
| May-15 | Burning issues |

In December, a reader survey of *Decision Point* was undertaken to enable future improvements in the delivery of information through this mechanism. The feedback received will be incorporated into future editions and the broader communication plan for the Centre.

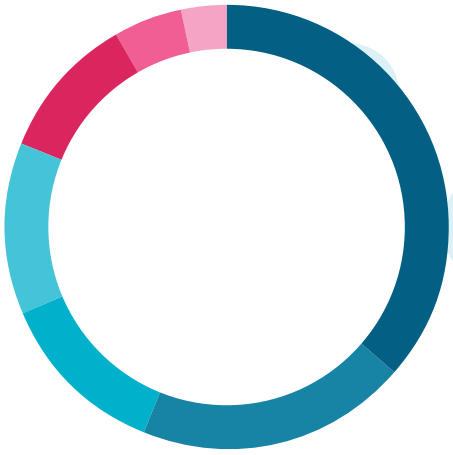



FIGURE 5 *Decision Point* subscribers by sector

## DECISION BRIEFS

In an effort to improve the way we share knowledge with stakeholders, during the year CEED began to develop a series of 'Decision Briefs' — these two to four page products synthesise CEED knowledge on priority issues and provide guidance on how this can be applied on the ground.

This information will form the basis of a legacy set of advice to inform decision-making. Three Decision Briefs have been competed this year on topics including offsets in conservation policy, how to harness citizen science, and understanding species distribution. Several more are in production and are expected to be available in early 2016.



# CEED's big bash gets creative

**Every two years CEED brings its people together in one place to share new ideas, reflect on what's been happening and plan for the future.**

The conference is our major internal communications exercise. In December, CEED's 2015 conference was held in Canberra hosted by the ANU node. As always, it generated a wealth of ideas and new collaborations, and gave CEED's members insights on what their fellow researchers are doing.

As with past conferences, a good deal of creativity was on display as the different nodes used a variety of techniques to convey the ideas behind their research.

Researchers from the University of Western Australia set up a series of mock interviews between a 'current affairs' journalist and an archetypical regional politician, an economist and a farmer to explore differing stakeholder values.

RMIT put on a quiz show inspired by the much loved TV program Spicks and Specks in which contestants had to guess the tune being sung using words from RMIT papers on urban biodiversity-sensitive design.

The University of Queensland node staged a play in which conservation planners drew up a reserve network for Middle Earth. The play explored the various tensions and trade-offs between different protected-area configurations with actors representing politicians, conservationists and researchers, all with their own points of view.

The conference heard keynote addresses from Dr Fiona Cameron on the work of the Australian Research Council; Professor Peter Kareiva from The Nature Conservancy and UCLA on conservation in the Anthropocene; Professors Emma Johnson (UNSW) and Mark Burgman (UM) on gender equity and conservation science; and Professor Cath Lovelock (UQ) on mangroves and sea level rise. There were also presentations from CEED's partner organisations in the United States, United Kingdom, Israel and Ireland. Planning sessions, media training and nature walks added further dimensions.

Much fun was had by all, as well as the sharing of big ideas. There were also several original songs performed during the proceedings — all of which made for a memorable, and possibly unique, meeting for an ARC Centre of Excellence.

# PUBLICATIONS

## In 2015 CEED again excelled in publishing our scientific findings in peer-reviewed, high ranking scientific journals, book chapters and reports.

CEED produced 190 publications comprised of 181 journal articles, four book chapters and five reports. As well as publishing a volume of items, we continued to publish items of high quality. Of the 181 journal articles, 29% were published in journals with an Impact Factor (IF) greater than five, which is a 4% increase on 2014 (see Figure 6). Eleven of these were in highly prestigious journals, with an IF greater than ten, including *Nature*, *Science*, *Nature Climate Change*, *TREE*, *Global Ecology & Biogeography* and the *Journal of Ecology*. CEED publications have appeared in 85 different journals across 16 different research areas (ISI Web of Science Categories), as diverse as Ecology, Economics, Forestry and Remote Sensing.

The publications included 63 (33%) involving multiple CEED nodes and 138 (73%) involving cross-institutional collaboration. Of the 181 publications, CEED researchers were the first-named author on 144 (76%).

CEED has again continued to emphasise the importance we place on the legacy of our Early Career Researchers (ECR), with 39% of our papers involving an ECR, and 23% of all our publications having an ECR as the 1st author on the paper.

We have also continued to work with other research institutions and end users in the publication of our science, with 72% of our 2015 publications involving more than one organisation, and 98% of them being co-authored.

Whilst having a journal article cited within the first year of its publication can be unusual, we managed to have accumulated 507 Google Scholar citations overall for 2015 papers, with 32% of our 2015 CEED journal articles having two or more citations. Seven CEED 2015 papers had more than 15 citations which is remarkable. This shows that our researchers are placing an importance on having our papers online, either through journals that are themselves open access or through paying for open access, and the importance our work holds for other researchers around the world.

In 2015, CEED produced 190 publications comprised of 181 journal articles, four book chapters and five reports.

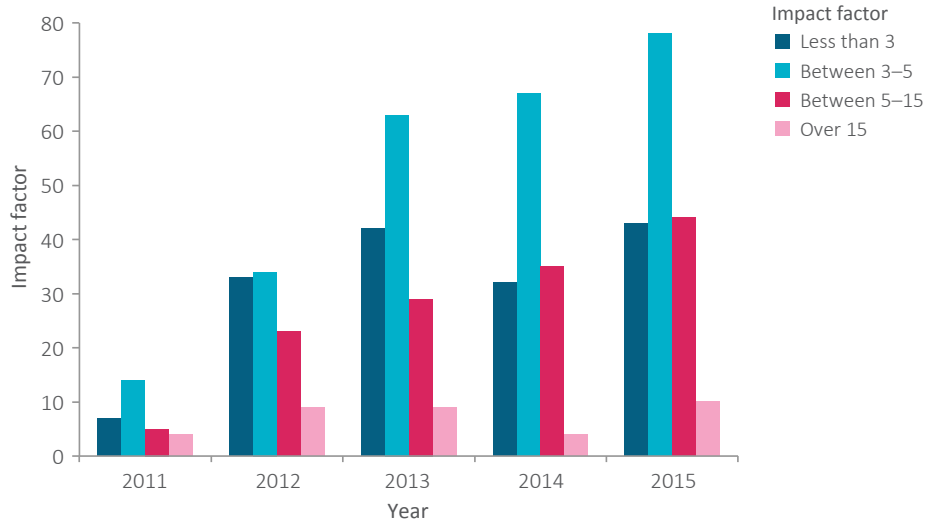



FIGURE 6 Impact factor categories for journal publications

## CEED 2015 PUBLICATIONS 1 JAN–31 DEC 2015

### *Book chapters (4)*

1 Bohensky EL, LS Evans, JM Anderies, D Biggs and C Fabricius (2015) Chapter 6 Principle 4–Foster complex adaptive systems thinking. In Principles for Building Resilience: Sustaining Ecosystem Services in Social-Ecological Systems. Cambridge University Press.

2 Hauser CE, GE Garrard and JL Moore (2015) Estimating detection rates. In Jarrad et al. (Eds) Biosecurity surveillance: quantitative approaches, CABI Publishing, Wallingford. ISBN-13: 978-1780643595.

3 Rhodes JR (2015) Mixture models for overdispersed data. Ecological Statistics: Contemporary Theory and Application, Oxford University Press, New York

4 Sharp S, GE Garrard and N Wong (2015) Planning, documenting and monitoring for grassland management. In Williams NSG, Marshall A & Morgan JW (Eds) Land of Sweeping Plains: Managing and restoring the native grasslands of south-eastern Australia, CSIRO Publishing. ISBN: 9781486300815.

### *Journal articles (181)*

1 Abram NK, E Meijaard, JA Wells, M Ancrenaz, AS Pellier, RK Runting, D Gaveau, S Wich, Nardiyono, A Tjiu, A Nurcahyo and K Mengersen (2015) Mapping perceptions of species' threats and population trends to inform conservation efforts: the Bornean orangutan case study. *Diversity And Distributions* **21(5):**487–499 ~ IF 3.667

2 Adams VM, AM Petty, MM Douglas, YM Buckley, KB Ferdinands, T Okazaki, DW Ko and SA Setterfield (2015) Distribution, demography and dispersal model of spatial spread of invasive plant populations with limited data. *Methods In Ecology And Evolution* **6(7):**782–794 ~ IF 6.554

3 Adams VM, SA Setterfield, MM Douglas, MJ Kennard, K Ferdinands (2015) Measuring benefits of protected area management: trends across realms and research gaps for freshwater systems. *Philosophical Transactions Of The Royal Society B-Biological Sciences* DOI:10.1098/rstb.2014.0274 ~ IF 7.055

4 Addison PFE, K de Bie and L Rumpff (2015) Setting conservation management thresholds using a novel participatory modeling approach. *Conservation Biology* **29(5):**1411–1422 ~ IF 4.165

5 Adler AA, GJ Doole, AJ Romera and PC Beukes (2015) Managing greenhouse gas emissions in two major dairy regions of New Zealand: A system-level evaluation. *Agricultural Systems* **135:**1–9 ~ IF 2.906

6 Ancillotto L, G Sozio, A Mortelliti (2015) Acorns were good until tannins were found: Factors affecting seed-selection in the hazel dormouse (Muscardinus avellanarius). *Mammalian Biology* **80(2):**135–140 ~ IF 1.478

7 Anthony KRN, PA Marshall, A Abdulla, R Beeden, C Bergh, R Black, CM Eakin, ET Game et al. (2015) Operationalizing resilience for adaptive coral reef management under global environmental change. *Global Change Biology* **21(1):**48–61 ~ IF 8.044

8 Auerbach N, KA Wilson, AIT Tulloch, JR Rhodes, JO Hansen and HP Possingham (2015) Effects of threat management interactions on conservation priorities. *Conservation Biology* **29(6):**1626–1635 ~ IF 4.165

9 Baker CM and M Bode (2015) Placing invasive species management in a spatiotemporal context. *Ecological Applications* DOI:10.1890/15-0095.1 ~ IF 4.093

10 Bardos DC, A Gurutzeta-Arroita and BA Wintle (2015) Valid auto-models for spatially autocorrelated occupancy and abundance data. *Methods In Ecology And Evolution* **6(10):**1137–1149 ~ IF 6.554

11 Bayraktarov E, MI Saunders, S Abdullah, M Mills, J Beher, HP Possingham, PJ Mumby and CE Lovelock (2015) The cost and feasibility of marine coastal restoration. *Ecological Applications* DOI:10.1890/15-1077.1 ~ IF 4.093

12 Beger M, J McGowan, EA Treml, AL Green, AT White, NH Wolff, CJ Klein, PJ Mumby and HP Possingham (2015) Integrating regional conservation priorities for multiple objectives into national policy. *Nature Communications* **6:**DOI 10.1038/ncomms9208 ~ IF 10.742

13 Bennett JR, JD Shaw, A Terauds, JP Smol, R Aerts, DM Bergstrom et al. (2015) Polar lessons learned: long-term management based on shared threats in Arctic and Antarctic environments. *Frontiers In Ecology And The Environment* **13(6)** ~ IF 7.441

14 Bennett JR, R Maloney and HP Possingham (2015) Biodiversity gains from efficient use of private sponsorship for flagship species conservation. *Proceedings Of The Royal Society B-Biological Sciences* DOI:10.1098/rspb.2014.2693 ~ IF 5.292

15 Berry LE, DA Driscoll, JA Stein, W Blanchard, SC Banks, RA Bradstock and DB Lindenmayer (2015) Identifying the location of fire refuges in wet forest ecosystems. *Ecological Applications* **25(8):**2337–2348 ~ IF 4.093

16 Berry LE, DA Driscoll, SC Banks and DB Lindenmayer (2015) The use of topographic fire refuges by the greater glider (*Petauroides volans*) and the mountain brushtail possum (*Trichosurus cunninghami*) following a landscape-scale fire. *Australian Mammology* **37(1):**39–45 ~ IF 0.831

17 Berry LE, DB Lindenmayer and DA Driscoll (2015) Large unburnt areas, not small unburnt patches, are needed to conserve avian diversity in fire-prone landscapes. *Journal Of Applied Ecology* **52(2):**486–495 ~ IF 4.564

18 Biggs D, CC Hicks, JE Cinner and CM Hall (2015) Marine tourism in the face of global change: The resilience of enterprises to crises in Thailand and Australia. *Ocean & Coastal Management* **105:**65–74 ~ IF 1.748

19 Bland LM, CDL Orme, J Bielby, B Collen, E Nicholson and MA McCarthy (2015) Cost-effective assessment of extinction risk with limited information. *Journal Of Applied Ecology* **52(4):**861–870 ~ IF 4.564

20 Boakes E, T Rout and B Collen (2015) Inferring species extinction: the use of sighting records. *Methods In Ecology And Evolution* DOI:10.1111/2041–210X.12365 ~ IF 6.554

21 Bode M, AIT Tulloch, M Mills, O Venter and AW Ando (2015) A conservation planning approach to mitigate the impacts of leakage from protected area networks. *Conservation Biology* **29(3):**765–774 ~ IF 4.165

22 Bode M, CM Baker and M Plein (2015) Eradicating down the food chain: Optimal multispecies eradication schedules for a commonly encountered invaded island ecosystem. *Journal Of Applied Ecology* **52(3):**571–579 ~ IF 4.564

23 Brown CJ, C White, M Beger, HS Grantham, BS Halpern, CJ Klein, PJ Mumby, VJD Tulloch, M Ruckelshaus and HP Possingham (2015) Fisheries and biodiversity benefits of using static versus dynamic models for designing marine reserve networks. *Ecosphere* **6(10)** ~ IF 2.255

24 Brown CJ, M Bode, O Venter, MD Barnes, J McGowan, CA Runge, JEM Watson and HP Possingham (2015) Effective conservation requires clear objectives and prioritizing actions, not places or species. *Proceedings Of The National Academy Of Sciences Of The United States Of America* **112(32)** ~ IF 9.809

25 Bruton MJ, M Maron, N Levin and CA McAlpine (2015) Testing the relevance of binary, mosaic and continuous landscape conceptualisations to reptiles in regenerating dryland landscapes. *Landscape Ecology* **30(4):**715–728 ~ IF 3.574

26 Bryan BA, RK Runting, T Capon, MP Perring, SC Cunningham, ME Kragt, M Nolan, EA Law, AR Renwick, S Eber, R Christian and KA Wilson (2015) Designer policy for carbon and biodiversity co-benefits under global change. *Nature Climate Change* DOI:10.1038/nclimate2874 ~ IF 15.49

27 Bull JW and A Gordon (2015) Schrödinger's microbe: implications of coercing a living organism into a coherent quantum mechanical state. *Biology and Philosophy* **30(6):**845–856 ~ IF 1.19

28 Bull JW, MJ Hardy, A Moilanen and A Gordon (2015) Categories of flexibility in biodiversity offsetting, and their implications for conservation. *Biological Conservation* **192:**522–532 ~ IF 3.762

29 Burns EL, DB Lindenmayer, J Stein, W Blanchard, L McBurney, D Blair and SC Banks (2015) Ecosystem assessment of mountain ash forest in the Central Highlands of Victoria, south-eastern Australia. *Austral Ecology* 10.1111/aec.12200 ~ IF 1.837

30 Butt N, L Seabrook, M Maron, BS Law, TP Dawson, J Syktus and CA McAlpine (2015) Cascading effects of climate extremes on vertebrate fauna through changes to low-latitude tree flowering and fruiting phenology. *Global Change Biology* **21(9):**3267–3277 ~ IF 8.044

31 Camac JS, RJ Williams, CH Wahren, F Jarrad, AA Hoffmann and PA Vesk (2015) Modeling rates of life form cover change in burned and unburned alpine heathland subject to experimental warming. *Oecologia* **178(2):**629–630 ~ IF 3093

32 Campbell HA, HL Beyer, TE Dennis, RG Dwyer, JD Forester, Y Fukuda, C Lynch, MA Hindell, N Menke, JM Morales, C Richardson, E Rodgers, G Taylor, ME Watts and DA Westcott (2015) Finding our way: On the sharing and reuse of animal telemetry data in Australasia. *Science of the Total Environment* DOI:10.1016/j.scitotenv.2015.01.089 ~ IF 4.099

33 Canessa S, G Guillera-Arroita, JJ Lahoz-Montfort, DM Southwell, DP Armstrong, I Chades, DP Armstrong, RC Lacy and SJ Converse (2015) When do we need more data? A primer on calculating the value of information for applied ecologists. *Methods In Ecology And Evolution* **6(10):**1219–1228 ~ IF 6.554

34 Carretero-Pinzon X, TR Defler, CA McAlpine and JR Rhodes (2015) What do we know about the effect of patch size on primate species across life history traits? *Biodiversity And Conservation* **25(1):**1–30 ~ IF 2.365

35 Carwardine J, C Hawkins, P Polglase, HP Possingham, A Reeson, AR Renwick, M Watts and TG Martin (2015) Spatial Priorities for Restoring Biodiverse Carbon Forests. *Bioscience* **65(4):**372–385 ~ IF 5.524

36 Conde DA, F Colchero, B Guneralp, M Gusset, B Skolnik, M Parr, O Byres, K Johnson, G Young, N Flesness, HP Possingham and JE Fa (2015) Opportunities and costs for preventing vertebrate extinctions. *Current biology* **25(6):**219–221 ~ IF 9.571

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4 Thackway R, P Cosier, EMcIntosh, D Saunders, H Possingham and C Sbrocchi (2015) Draft Protocol for Constructing a Native Vegetation Condition Account. *Australian Regional Environmental Accounts* Working Paper Series (1/5), Wentworth Group of Concerned Scientists, Sydney

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# OUR PEOPLE

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### *Director*

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| Assoc. Prof Sarah Bekessey (Theme C) | RMIT |
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| Assoc. Prof Salit Kark | UQ |
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| Prof Michael McCarthy | UM |
| Dr Eve McDonald-Madden | UQ |
| Prof David Pannell | UWA |
| Prof Hugh Possingham | UQ |
| Assoc. Prof Jonathan Rhodes | UQ |
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- AgResearch, Grasslands Research Centre, New Zealand
- Alluvium, Australia
- Annapolis, MD, USA
- ARUP Consulting, Australia
- Australian Antarctic Division
- Australian Bureau of Statistics
- Australian Conservation Foundation, Australia
- Australian Institute for Marine Science
- Biosecurity South Australian Government, Australia
- Birds Australia, Australia
- Birdlife Australia, Australia
- BirdLife International Cambodia Programme, Cambodia
- Bush Heritage, Australia
- Center for International Forestry Research (CIFOR), Indonesia
- Center for Large Landscape Conservation, USA
- Central Tablelands LLS, Australia
- Centre Tecnològic Forestal de Catalunya (CTFC), Spain
- City of Ballarat, Australia
- City of Melbourne, Australia
- CNRS, France
- Colombian Primatological Association, Colombia
- Committee for Economic Development of Australia, Australia
- Conservation Council, Australia
- Conservation International, USA
- CSIRO Land and Water, Western Australia, Australia
- Dennis Family Homes, Australia
- Department of Conservation, New Zealand
- Department of Parks and Wildlife, Western Australia, Australia
- Department of the Environment, Australia
- Department of Environment, Land, Water and Planning, Victoria, Australia
- Department of Agriculture and Food, Western Australia, Australia
- Department of Environment, Water and Natural Resources, South Australia, Australia
- Department of Primary Industries, Parks, Water and Environment (DPIPWE), Tasmania, Australia
- Earthwatch, Brazil
- Fundacion Proyecto Titi, Colombia
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- Georgia Institute of Technology, USA
- Gondwana Link Ltd, Western Australia, Australia
- Greenfleet Australia
- Growth Areas Authority, Australia
- Hungarian Natural History Museum, Hungary
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- Institute of Ecology and Biodiversity, Chile IUCN, Switzerland
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- Kids Teaching Kids, Australia
- Lake Cowal Conservation Centre, Australia
- Landcare Research, New Zealand
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- Nature Conservation Trust of NSW, Australia
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## COLLABORATORS *continued...*

- Norman Wettenhall Foundation, Australia
- NSW Office of Environment and Heritage, Australia
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- Parks Australia, Australia
- Parks and Wildlife Commission NT, Australia
- People and Nature Consulting International, Indonesia
- Pew Charitable Trust, Australia
- Provita, Venezuela
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- Stockholm Resilience Centre, Sweden
- Stockland, Australia
- Sustainability Victoria, Australia
- Tasmanian Land Conservancy, Australia
- Terrestrial Ecosystems Research Network, Australia
- The Biodiversity Consultancy, UK
- The European Commission
- The Institute of Zoology at the Zoological Society of London, UK
- The National Centre for Scientific Research, France
- The National Oceanographic & Limnological Research Israel
- The Nature Conservancy, Australia
- The Orangutan Project, Indonesia
- Tiwi Land Council, Australia
- TreeDivNet (Global Tree Diversity Network), Ghent University, Belgium
- Trusts for Nature (Victoria), Australia85 Urban Design Forum, Australia
- UN Cities Program
- UNEP-GRASP, Kenya
- University of British Columbia, Canada
- University of Illinois, USA
- University of Helsinki, Finland
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- University of Montreal, Canada
- University of Sao Paulo, Brazil
- University of Wisconsin-Madison, USA
- US Geological Survey, USA
- Victorian Indigenous Architects Association
- Wageningen University, Netherlands
- Waterwatch, Australia
- Wentworth Group of Concerned Scientists, Australia
- Wildlife Conservation Society, Kenya
- Wildlife Conservation Society Cambodia Program, Cambodia
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# PERFORMANCE MEASURES

## KEY RESULT AREA

| KEY RESULT AREA | PERFORMANCE MEASURE | TARGET 2015 | OUTCOME 2015 |
|---|---|---|---|
| Research findings | Number of research outputs: | 80 | 181 |
| | • *Peer reviewed publications* | | |
| | Quality of research outputs | 50% | 68% |
| | • *50% of papers with IF in top 25% of ecology journals* | | |
| | Number of invited talks / papers / keynote lectures given at major international meetings: | | |
| | • *Plenary talks at international conferences* | 9 | 15 |
| | • *Invitations to international workshops and conferences not covered above* | 30 | 119 |
| | Number and nature of commentaries about the Centre's achievements | 5 | 10 |
| Research training and professional education | Number of attended professional training courses for staff and students | 20 | 54 |
| | Number of Centre attendees at all professional training courses | 60 | 58 |
| | Number of new postgraduate students working on core Centre research and supervised by Centre staff (including PhD, Masters by research and coursework) | 7 | 5 |
| | Number of new postdoctoral researchers recruited to the Centre working on core Centre research | 6 | 5 |
| | Number of new Honours students working on core Centre research and supervised by Centre staff | 10 | 2 |
| | Number of postgraduate completions and completion times, by students working on core Centre research and supervised by Centre staff: | 11 | |
| | • *PhD: 3–4 years* | | 16 |
| | • *Masters by research: 2 years* | | 5 |
| | Number of Early Career Researchers (within five years of completing PhD) working on core Centre research | 15 | 48 |
| | Number of students mentored | 50 | 88 |
| | Number of mentoring programs | 1 | 4 |
| International, national and regional links and networks | Number of international visitors and visiting fellows: | | |
| | • *For 10 days or more* | 10 | 32 |
| | • *For less than 10 days* | 20 | 29 |
| | Number of national and international workshops held / organised by the Centre | 8 | 26 |
| | Number of visits to overseas laboratories and facilities | | |
| | • *For 10 days or more* | 15 | 36 |
| | • *For less than 10 days* | 30 | 72 |
| End-user links | Number of government, industry and business community briefings | 20 | 183 |
| | Number and nature of public awareness programs | 10 | 80 |
| | Number of website hits | 50,000 | 139,306 |
| | Number of public talks given by Centre staff | 80 | 52 |

## KEY RESULT AREA *continued...*

| KEY RESULT AREA | PERFORMANCE MEASURE | TARGET 2015 | OUTCOME 2015 |
|---|---|---|---|
| Organisational support | Annual cash contributions from Collaborating Organisations | | |
| | *The University of Queensland* | $386,439 | $387,238.75 |
| | *University of Melbourne* | $131,675 | $132,192 |
| | *University of Western Australia* | $203,184 | $203,183.86 |
| | *Australian National University* | $55,458 | $55,458 |
| | *RMIT University* | $56,630 | $56,630 |
| | Annual in-kind contributions from Collaborating Organisations | | |
| | *The University of Queensland* | $400,383 | $494,237 |
| | *University of Melbourne* | $131,675 | $131,675 |
| | *University of Western Australia* | $197,696 | $197,696 |
| | *Australian National University* | $138,936 | $138,936 |
| | *RMIT University* | $51,330 | $51,330 |
| | Annual cash contributions from Partner Organisations | 0 | 0 |
| | Annual in-kind contributions from Partner Organisations | | |
| | *Hebrew University of Jerusalem* | $15,000 | $15,000 |
| | *CSIRO* | $26,857 | $26,857 |
| | *Imperial College* | $24,114 | $24,114 |
| | *US Geological Survey* | $12,000 | $12,000 |
| | Other research income secured by Centre staff | | |
| | • *Other ARC grants* | $1,000,000 | $1,390,487 |
| | • *Other Australian competitive grants* | $500,000 | – |
| | • *Grants from public sector* | $70,000 | $33,727,641* |
| | • *Industry and CRCs* | $55,000 | $67,700 |
| | • *Other research income* | – | $310,150 |
| | Number of new organisations collaborating with, or involved in, the Centre | 2 | 33 |
| National benefit | Contribution to the National Research Priorities and the National Innovation Priorities | | |
| | *Briefings to government, business and interest groups* | | 183 |
| | *Cross-nodal publications* | | 63 |
| | *Cross-institutional publications* | | 138 |
| | *Submissions to government on policy matters* | | 45 |
| Indicators | *End-user Links* | | |
| | • *Internally produced Magazine, issues* | 10 | 9 |
| | • *Separate media stories (releases)* | 10 | 21 |
| | • *Media outputs, articles, radio* | 100 | 1,938 |
| | • *Memberships of national and international boards and advisory committees* | 20 | 65 |

** $29,980,000 received from the NESP. The NESP TSR hub has an intense focus on the recovery of Australian threatened species. That focus is not a core mission in CEED, but CEED research underpins a great deal of TSR hub research and most of the CEED researchers play some role in the much bigger TSR hub — which has 47 chief investigators.*

## FINANCES

The Australian Research Council Centre of Excellence for Environmental Decisions formally commenced operations in 2011. The Centre's financial operations are conducted within the established procedures, controls and delegations of the relevant collaborators and partner institutions and as set out by the Australian Research Council.

In 2015, the ARC CEED received $1,952,842 in income from the ARC with the collaborating organisations contributing a further $834,702.61 in cash contributions. In terms of expenditure $4,284,173 was expended during 2015 on personnel, travel, scholarships, research workshops, administration, communication and consumables. This statement provides an analysis of the income and expenditure of the Centre of Excellence.

### *Collaborating Organisation Funding*

Cash contributions to the Centre of Excellence from the administering and collaborating organisations totalled $834,702.61. This was composed of:

| | |
|---|---|
| UQ | $387,238.75 |
| UM | $132,192 |
| ANU | $55,458 |
| RMIT | $56,630 |
| UWA | $203,183.86 |

### *In-Kind Contributions*

In-kind support totaled $1,013,874 from the administering and collaborating organisations. The in-kind contributions are primarily for personnel (e.g salaries and on-costs), support for RHD students, administration and office costs, and facilities.

### *Partner Contributions*

The CEED is very grateful for the support of its partner organisations who contribute expertise towards the Centre's research agenda, and assist in mentoring early career researchers. In 2015 the Centre's partner organisations contributed $77,971 towards CEED with this primarily to support the partner investigator's time.

### *Expenditure*

Expenditure for CEED totalled $4,284,173 in 2015. This was composed of salaries for personnel, equipment, travel, research maintenance and consumables, scholarships, communication and administration. The highest expenditure item was salaries for personnel at $3,332,212.97. Travel was also a priority for the Centre with $327,022.22 expended to ensure researchers undertook fieldwork, visited other nodes, presented at conferences and attended research workshops and made linkages and collaborations nationally and internationally. Other expenditure was on items including centre administrative costs ($36,867.55), specialised expertise ($64,800), equipment ($30,552.90), communication activities ($49,995.25) and research workshops ($51,473.10).

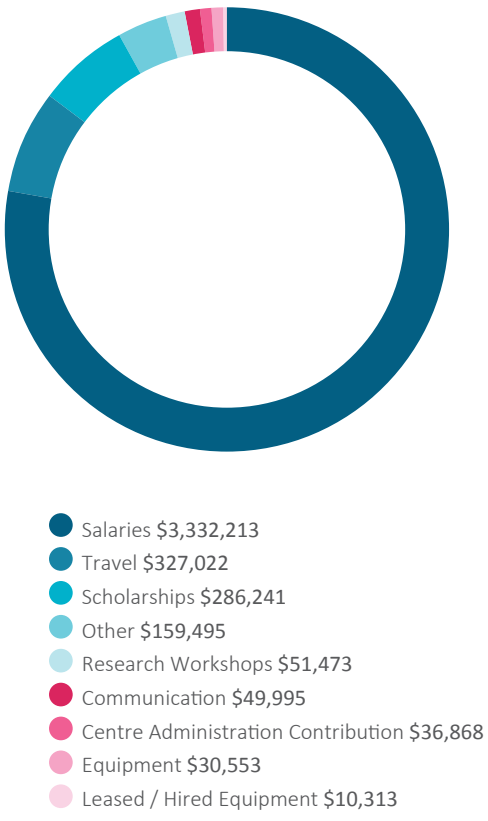


FIGURE 7 Income and expenditure

*Statement of Operating Income and Expenditure for year ended 31 December 2015*

| INCOME | 2015 ($) |
|---|---|
| ARC Centre Grant | $1,952,842 |
| Host Institutions cash support | $834,702.61 |
| Total Income | $2,787,544.61 |

| EXPENDITURE | 2015 ($) |
|---|---|
| Salaries | $3,332,212.97 |
| Equipment | $30,552.90 |
| Travel | $327,022.22 |
| Leased / Hired equipment | $10,313.04 |
| Scholarships | $286,241.00 |
| Centre administration | $36,867.55 |
| Communication and outreach | $49,995.25 |
| Research Workshops | $51,473.10 |
| Other | $159,494.97 |
| Total Expenditure | $4,284,173.00 |

# ABBREVIATIONS

| | |
|---|---|
| ANU | The Australian National University |
| ARC | Australian Research Council |
| ARCUE | Australian Research Centre for Urban Ecology |
| CEED | Centre of Excellence for Environmental Decisions |
| CTI | Coral Triangle Initiative |
| ECR | Early Career Researcher |
| EDA | Environmental Decisions Alliance |
| GIZ | German Sustainable Development |
| GU | Griffith University |
| HUJI | The Hebrew University of Jerusalem |
| ICCB | International Congress for Conservation Biology |
| IPBES | International Platform on Biodiversity and Ecosystem Services |
| ISAP | International Scientific Advisory Panel |
| MPA | Marine Protected Area |
| NCEAS | National Center for Ecological Analysis and Synthesis |
| RMIT | RMIT University |
| UM | The University of Melbourne |
| UQ | The University of Queensland |
| USAID | United States Agency for International Development |
| UWA | The University of Western Australia |
| WCS | The Wildlife Conservation Society |

## IMAGE CREDITS

| PAGE | DESCRIPTION | CREDIT |
|---|---|---|
| OFC | Yellow-tailed black cockatoo male (*Calyptorhynchus funereus*) | D. Cook |
| 1 | Turtle on ocean floor at Heron Island | XL Catlin Seaview Survey |
| 2 | Red-spectacled Amazon Parrot | Hamadryades |
| 4 | Tasmanian wilderness | B. Kendell |
| 9 | Ribbon Reef, Kyra and Cod | XL Catlin Seaview Survey |
| 10 | Striped legless lizards (Delma impar) | B. Howland |
| 14 | Southern brown bandicoot (*Isoodon obesulus obesulus*) | J. Chapman |
| 14 | INSET: Forty-spotted pardalote (*Pardalotus quadragintus*) | H. Cook |
| 15 | Edge road and public walk and cyle ways form a fire buffer between suburb and reserve | K. Eyles |
| 16 | Juvenile Grey-headed flying foxes (*Pteropus poliocephalus*) | J. Welbergen |
| 17 | Shrubs and seedlings planted in a new urban greenspace | K. Eyles |
| 18 | Koala on road | L. Joseph |
| 19 | Flowerdale Victoria, after Bushfires | E. Donoghue, FlickrCC- BYNCND2 |
| 20 | Log by water | A. van Niekerk |
| 21 | Distant mountains | L. Joseph |
| 22 | Polar bear | A. Teraud |
| 23 | Loggerhead Sea Turtle | V. Miller |
| 24 | Fishing boats Chile | K. Davis |
| 24 | INSET: Katrina Davis (right) with intern Faustine Auzanneau interviewed local stakeholders | M. Guerrero Gatica |
| 25 | Brain coral | XL Catlin Seaview Survey |
| 26 | Stone Fish | XL Catlin Seaview Survey |
| 27 | Orangutan in forest | C. Morgans |
| 28 | Southern White Rhino | R. Biggs |
| 29 | NZ lake | K. Connors |
| 29 | INSET: Cows in NZ | D. Young Flickr CC |
| 30 | Green Turtle | XL Catlin Seaview Survey |
| 30 | INSET: Eastern Curlew | DS Hovorka |
| 31 | Striped Faced Dunnart | J. Ringma Flickr CC |
| 32 | Alpine Tree Frog | Flickr CC David-Hunter |
| 33 | An earth mover rolls out rocks at a large-scale in grasslands near Canberra | A. Smith |
| 34 | Tree in a paddock | Dollarphotoclub |
| 35 | Man with cows | S. Cooke |
| 36 | Cows in paddock | Dollarphotoclub |
| 37 | Jane Elith, winner of the 2015 Frank Fenner Prize for Life Scientist of the Year, presented at the Prime Minister's Prizes for Science | Wildbear |
| 39 | Eve McDonald-Madden accepting the Thomson Reuters Citation Award on behalf of the team (with (L) Jeroen Prinsen, TR Senior Director for Australasia, and (R) David Brown, Global Head of Sales) | E. McDonald-Madden |
| 40 | CEED Leadership Program cohort at ICCB. L–R: Payal Bal, Luke Kelly, Megan Evans, Nathalie Butt, Sam Nicol, Ramona Maggini, Martina di Fonzo, Jeremy Simmonds | anon |
| 41 | Dr Martina Di Fonzo | M. Di Fonzo |
| 42 | Reef fish and coral | XL Catlin Seaview Survey |
| 43 | INSET: Residents engage in habitat restoration activities in a local nature reserve | K. Eyles |
| 44 | Attendees (caption already present) | M. Evans |
| 47 | Esti Palmer | E. Palma |
| 48 | Emperor Penguins in Antarctica | M. de Jong-Lantink |
| 51 | Grey-headed flying fox (*Pteropus poliocephalus*) | L. Ruytenberg |
| 53 | Media training at the CEED bi-annual Conference 2015 | Currie Communications |
| 54 | Karen Ikin | K. Eyles |
| 56 | Sugeng Budiharta (L) counting epiphytic orchids in Indonesian forests | S. Budiharta |
| 61 | Katrina Davis at the Pontifocal Catholic University of Chile's Station for Coastal Marine Investigations (Pontificia Universidad Catolica de Chile, Estacion Costera de Investigaciones Marinas) | K. Davis |
| 62 | Grassland earless dragon (*Tympanocryptis pinguicolla*) | B. Howland |
| 66 | Estibaliz Pama collecting samples of Dipsacum fullonum to measure leaf traits | E. Palmer |
| 67 | UWA CEED members at the CEED Bi-Annual conference 2015. L-R Marit Kragg, David Pannell, Richard Hobbs, Mike Craig & Fiona Gibson | D. Salt |
| 68 | Red-tailed Black Cockatoo | Redtail Graphic Design |
| 79 | Salit Kark and her lab members at Laminton National Park | S. Kark |
| 85 | Red flowers | A. van Niekerk |
| 90 | Growling grass frog (*Litoria raniformis*) | G. Heard |


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