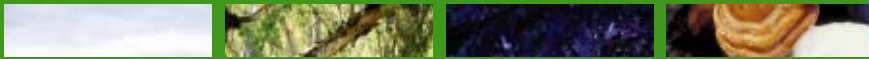


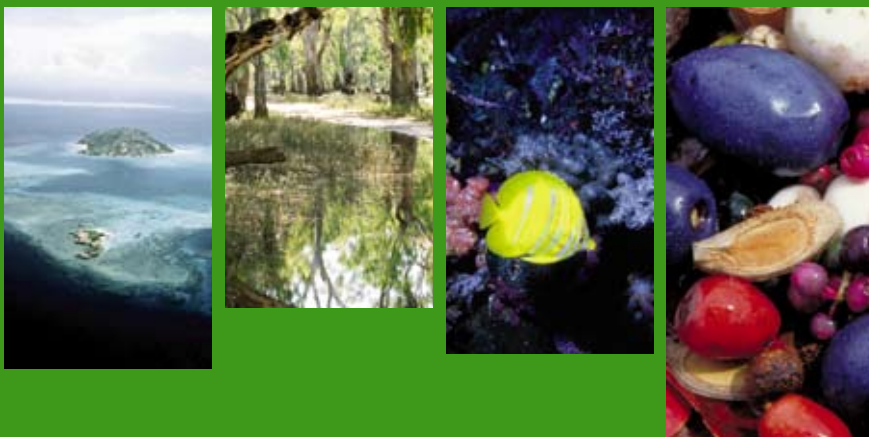
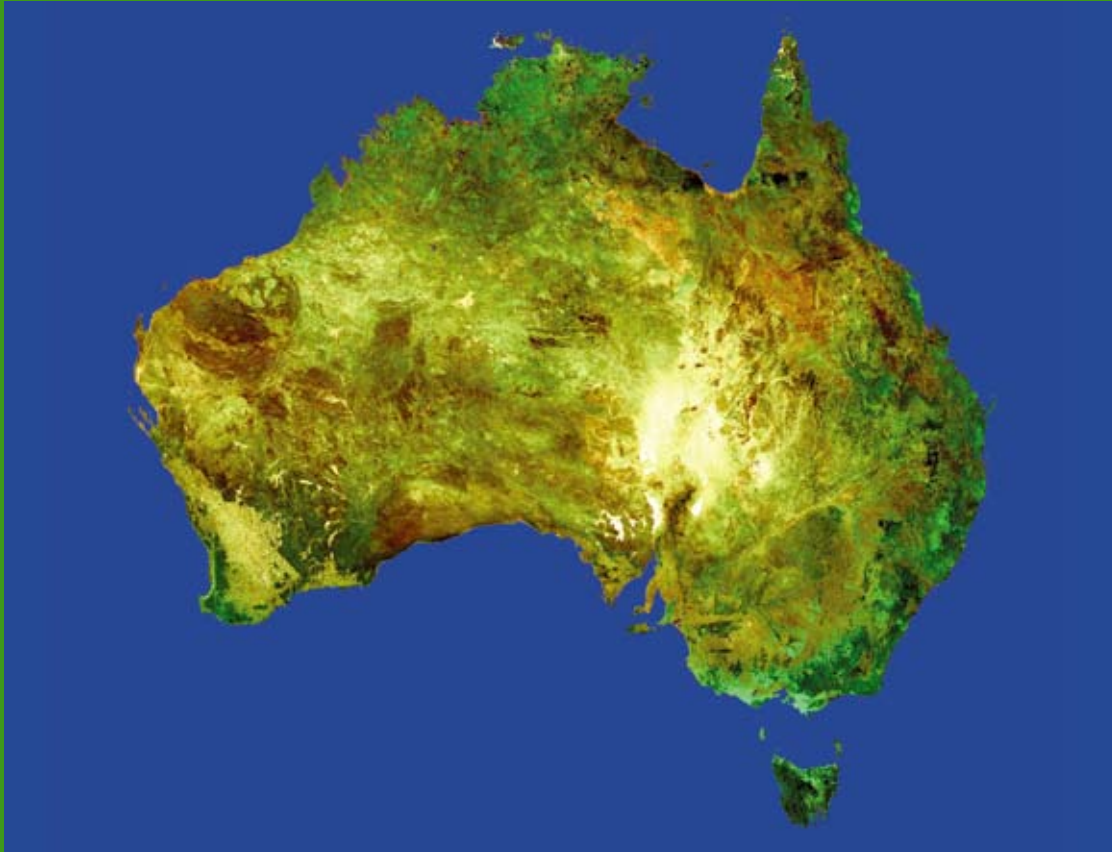


Australian Government

Department of the Environment, Water, Heritage and the Arts



Commonwealth Environment Research Facilities



Research Program Overview



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CERF Research Overview

Foreword



The Minister for the Environment, Heritage and the Arts,
the Hon. Peter Garrett MP

I am pleased to introduce this research overview of the Commonwealth Environment Research Facilities (CERF) program. Since its inception in 2005, the CERF program has facilitated world-class, public good research to improve our understanding and inform our response to the challenges facing Australia's biodiversity.

Valuing biodiversity and the ecosystem services it provides is crucial. Applying the knowledge gained through research requires creative approaches. The CERF program funding of \$100 million has provided a unique opportunity for institutions to form multi-disciplinary, collaborative 'research hubs'. These hubs have produced innovative research, enabling more responsive management which is sensitive to the current and emerging priorities for the conservation and use of Australia's environmental assets.

The CERF program has forged strong partnerships between research institutions, environmental managers, industry, community and government agencies. The program provides a direct pathway to influencing the management and sustainable use of our environment, actively involving the 'users' of the information in setting the direction of the research.

This research overview provides a valuable insight to the variety of projects being conducted under the auspices of the CERF program. It also provides contact details for the principal researchers to enable a greater level of collaboration across the environmental research and policy fields.

I congratulate the CERF researchers on their commitment to the program and look forward to continued innovative research to help us address the challenges facing Australia's biodiversity.

A handwritten signature in black ink, appearing to read 'Peter Garrett', with a long, sweeping underline that extends to the right.

Peter Garrett
Minister for the Environment, Heritage and the Arts
September 2008

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Introduction

Commonwealth Environment Research Facilities

The Commonwealth Environment Research Facilities (CERF) program is the Australian Government's \$100 million commitment to world-class public good environmental research.

The CERF initiative aims to improve Australia's capacity to understand and respond to priority environment concerns. The fund will support environmental public policy objectives in a range of critical areas and draw on multiple disciplines, professional partnerships and existing research efforts.

Over a four-year period, \$60 million is being invested in national priorities for environmental research, primarily through establishing multi-disciplinary research hubs, organised as partnerships between a range of collaborating institutions, organisations and research teams.

Funds have also been allocated to support Significant Projects and Fellowships addressing specific areas of research over a period of one to three years.

As part of CERF, \$40 million has been provided for a Marine and Tropical Sciences Research Facility (MTRSF) which is focussed on sustaining the health of North Queensland's public environmental assets – particularly the Great Barrier Reef and its catchments, its tropical rainforests including the Wet Tropics World Heritage Area, and Torres Strait.



CERF Reference Group

The CERF Reference Group comprises leading members of Australia's environment research community and was established to advise the Australian Government on the delivery of its \$100 million Commonwealth Environment Research Facilities (CERF) program.

Chair

Mr Greg Bourne – WWF Australia

Members (2008 onwards)

Professor Angela Arthington – Griffith University

Professor David Bowman – University of Tasmania

Mr Andrew Campbell – Triple Helix Consulting Pty Ltd

Professor Peter Davies – University of Western Australia

Professor Steven Halls – Murdoch University

Professor Alfred Huang – University of South Australia

Professor Bruce Mapstone – Centre for Australian Climate and Weather Research (CACWR)

Dr Deborah Peterson – Department of Primary Industries (Victoria)

Emeritus Professor Warren Musgrave – University of New South Wales

Associate Professor Bob Beeton – University of Queensland

Professor Mark Burgman – University of Melbourne

Past members (2005–2007)

Professor Adrienne Clarke – University of Melbourne

Dr Graham Harris – ESE Systems Pty Ltd

Professor Ted Lefroy – University of Tasmania



CERF Research Hub

Name

Tropical Rivers and Coastal Knowledge (TRaCK)

Australian Government Funding

\$8.8 million

Principal Research Leader

Name: Associate Professor Michael Douglas

Position: Director, TRaCK Research Hub

Institution: Charles Darwin University

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Web site: www.track.gov.au



Associate Professor Michael Douglas is an aquatic ecologist. For the past 16 years his work has focussed on understanding the effects of catchment management practices (including fire, weed, forestry and water management) on tropical freshwater ecosystems. Michael has worked on aquatic plant and animal (invertebrate and fish) communities and ecosystem processes in tropical streams and rivers, floodplains and riparian zones. He also works on weed management in tropical savannas, particularly the environmental impacts of exotic grasses. He has led several large-scale multidisciplinary research programs in northern Australia and has been Director of the TRaCK Research Hub since 2007.

Summary

Aim: To provide the science and knowledge that government, communities and industries need for the sustainable use and management of Australia's tropical rivers and coasts.

Activities: Research will be undertaken within seven interconnected themes.

1. Scenario evaluation draws from all other themes to deliver scenario evaluation tools for exploring the implications of change for our tropical rivers and estuaries.
2. Values and assets examines the social and cultural values embodied in our tropical rivers and estuaries and how they influence social behaviour patterns.
3. Riverscape and coastal settings is developing a socio-economic profile of each catchment and a physical classification system to characterise rivers and estuaries in the region.
4. Material budgets is developing models to predict the effects of land and water use on the sources, amounts and movement of water, carbon, sediment, and nutrients and developing tools for monitoring and assessing water quality and quantity.
5. Food webs and biodiversity is identifying the sources of organic carbon underpinning riverine food webs, determining the trophic interactions that have a strong influence on carbon and nutrient flow to higher trophic levels, and developing tools for determining environmental flows and monitoring biodiversity and ecological condition.
6. Sustainable enterprises is identifying sustainable and culturally appropriate uses of riverine and coastal resources, which offer opportunities for innovative enterprise development in remote and regional communities.
7. Communicating and integrating is synthesising knowledge from the different themes and tailoring it to local communities, regional natural resource management bodies and government policy makers.

Outcomes:

- increased understanding of the environmental, cultural, economic and social benefits provided by tropical rivers and coasts
- improved methods and tools for assessing the implications of current use and potential developments
- identification of opportunities for sustainable enterprise development, and
- improved capacity and knowledge to manage Australia's tropical rivers and coasts.

CERF Research Hub

Name

Applied Environmental Decision Analysis (AEDA)

Australian Government Funding

\$7.56 million

Principal Research Leader

Name: Professor Hugh Possingham

Position: Director, The Ecology Centre

Institution: University of Queensland

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Professor Hugh Possingham is an applied theoretical ecologist and one of the Australia's most influential conservation scientists. His research focuses on decision-theory approaches to making conservation decisions, in particular conservation planning and optimal monitoring. Hugh led the development of MARXAN, a systematic conservation planning tool now used by over 1300 users in over 80 countries worldwide. The software underpinned the rezoning of the Great Barrier Reef Marine Park. Hugh heads The Ecology Centre at the University of Queensland, has won many important conservation honours in recent years and serves on a variety of high level boards and committees. He is a Fellow of the Australian Academy of Science as well as being a Federation Fellow.

Summary

AEDA's primary aim is to explore, invent, test and disseminate better methods for making decisions that lead to more cost-effective and reliable conservation outcomes. The key scientific challenge for the research hub is to develop approaches to decision making that:

- honestly and completely characterises uncertainty, and
- synthesises species and landscape responses to disturbance within a framework that accounts for competing demands on natural resources.

The hub's activities will focus on innovation in three areas:

- 1. Optimal monitoring:** examining why, what and how monitoring is carried out in order to ensure it is done effectively. This theme also examines how much money is spent on what. The basic challenge this area aims to satisfy is: how much information do I need to make a good decision?
Specific examples of this include protocols for cost-effective monitoring and management of invasive species in Australian alpine ecosystems incorporating competitive dynamics under climate change; optimal surveillance of bio-invasions from ships' ballast; and optimal monitoring and management of arboreal marsupial habitat in landscapes managed for timber harvesting.
- 2. Prioritisation and spatial planning:** research on how resources are best applied in issues such as designing reserves or allocating funds for the management of threatened species.
Specific examples of this research includes optimal spatial resource allocation for biodiversity conservation; the scheduling of fine scale conservation priorities with diminishing options; and the optimal allocation of environmental flows with uncertain ecological benefits and high agricultural opportunity costs.
- 3. Environmental decision making:** investigating how we make decisions. This theme overarches everything AEDA does. How do groups of people come to make decisions? Specific examples include optimal strategies for feral animal control and biodiversity conservation; fire management; biodiversity conservation and human property protection at the urban/rural interface; evaluating the success of riverine and vegetation restoration within a bio-economic framework; and translocations as a management strategy for climate change management with a plan for learning.

CERF Research Hub

Name

Landscape Logic: Linking Land and Water to Resource Conditions

Australian Government Funding

\$8.75 million

Principal Research Leader

Name: Professor Ted Lefroy

Position: Director, Centre for Environment

Institution: University of Tasmania

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Web site: www.landscapelogic.org.au



Professor Ted Lefroy studied agricultural science at the University of WA, worked in rural extension in Queensland, Papua New Guinea and Western Australia for fifteen years, then took up a research position at the Department of Agriculture in Perth. Ted's research into perennial farming systems, water use in agroforestry systems and tree-crop competition led him to the CRC for Legumes in Mediterranean Agriculture and then CSIRO Sustainable Ecosystems where his research interests broadened to include the integration of nature conservation in farming landscapes. In 2005 he took up his current position as Director of the Centre for Environment at the University of Tasmania in 2005.

Summary

The Landscape Logic CERF Hub is a partnership between six regional natural resource management organisations, six research institutions and three state land management agencies. Our focus is to improve the quality of information available to regional natural resource management agencies. Our aims are to 1) Use decision networks to better organize existing knowledge and assumptions about links between management actions and environmental outcomes and 2) Improve our understanding of the links between management actions and environmental outcomes through retrospective studies of the effects of past investment into water quality and native vegetation condition.

Our activities are structured into three themes, Knowledge Discovery (60% of people and resources) Knowledge Integration (30%) and Knowledge Broking (10%). The KI theme consists of one project that is building decision networks with regional bodies to assist their investment decisions (Tony Jakeman, ANU). The KD theme has five projects, Spatial Analysis and Database (Tony Norton, UTAS), Social Research (Allan Curtis, CSU), Victorian Retrospective (Adam Hood, DSE), Tasmanian Retrospective (Bill Cotching, UTAS), and Catchment Nutrient and Sediment Management (Hamish Cresswell, CSIRO). The KB project is led by Geoff Park (North Central CMA, Victoria) and Jennifer Hemer (UTAS). The Victorian retrospective project is studying past private and public investment in native vegetation in northern Victoria for quantifiable links to condition change. The Tasmanian Retrospective is examining the links between changes in land use and land management, riverine condition, water quality, and estuarine condition in multiple catchments.

Our expected outcomes are 1) Improved understanding of the effectiveness of past intervention in vegetation management, 2) Improved prioritisation for management of water quality through identification of critical source areas of nutrients and sediment, 3) Social learning about the inter-dependencies between management decisions, 4) Decision support tools designed with regional organisations for multi-objective natural resource planning and investment and 5) Improved management and investment in natural resources through better understanding of past response to management.

CERF Research Hub

Name

Australian Marine Mammal Centre (AMMC)

Australian Government Funding

\$2.75 million

Principal Research Leader

Name: Dr Nick Gales

Position: Leader, AMMC

Institution: Australian Antarctic Division

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Web site: www.aad.gov.au



Dr Nick Gales, BVMS, PhD, has been involved in marine mammal research and management since 1980. He has worked on a wide range of management related marine mammal research in Australia, Antarctica, New Zealand and the USA. This work has included eco-physiology, demography and fishery interactions of a number of seal species, effects of tourism on dolphins, and the foraging ecology and movements of dugongs, seals and whales. Since 2001 Nick has been based at the Australian Antarctic Division (AAD) in Hobart, Tasmania. Nick is the Australian delegation leader to the Scientific Committee of the International Whaling Commission and the Australasian coordinator of the IUCN Cetacean Specialist Group. Nick has published widely in the scientific and popular literature (more than eighty refereed scientific papers).

Summary

The Australian Marine Mammal Centre (AMMC) was established in 2006 as the first major national research centre focused on understanding, protecting and conserving the whales, dolphins, seals and dugongs in our region. We coordinate Australia's marine mammal research expertise to provide scientific research and advice to underpin Australia's marine mammal conservation and policy initiatives. The AMMC provides an integrated, strategic, cross-jurisdictional approach supporting marine mammal conservation, management and policy priorities.

Our objectives are to:

- quantify marine mammal distribution, behaviour and environmental linkages
- characterise and quantify threats to marine mammal populations, and
- develop risk management and mitigation strategies and test their efficacy.

Our research priorities reflect the current view of the most pressing knowledge gaps:

- quantify the status, dynamics and forcing factors (physical, biological) of marine mammal population structure, distribution and abundance
- characterise and quantify threats to marine mammal populations, with a focus on understanding the nature and extent of interactions with humans
- develop risk management and mitigation tools/strategies for marine mammal and human interactions and test their efficacy, and
- develop powerful, new, non-lethal technologies and methodologies (e.g. molecular, bio-logging, remote sensing) that best address the above objectives.

The AMMC is based at the AAD and has an extensive network of science linkage partners throughout Australia. A stakeholder advisory committee and a scientific committee work with AMMC staff to review priority research needs and select competitive bids for commissioned research. The AMMC was established with initial funding from the Australian Government's \$100 million CERF program and existing staff and resources from the AAD's marine mammal research group. With further funding from other Government marine mammal research funds, universities and industry groups, AMMC is establishing a substantial, contestable fund from which commissioned, prioritised research is being conducted.

CERF Research Hub

Name

Prediction and Management of Australia's Marine Biodiversity

Australian Government Funding

\$6.6 million

Principal Research Leader

Name: Professor Nic Bax

Position: Principal Investigator and Leader, CERF Marine Biodiversity Hub

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Web site: www.marinehub.org



Professor Nic Bax has 30 years' experience in developing options to improve marine resource management and conservation. He has led teams of marine biologists in Australia, the United States and Europe responding to oil spills, deepwater fisheries, developing comprehensive resource assessments of marine ecosystems, creating options to manage invasive marine species, and conserving marine biodiversity. Nic has worked in the private and public sectors on technology development, environmental impact assessment, environmental design and mitigation. He has served on national and international working groups, committees and boards to promote scientific approaches to marine conservation. He leads the CSIRO Marine Biodiversity and Conservation research group.

Ph.D., Fisheries, University of Washington, Seattle, Washington, 1983.

M.A., Cambridge University, 1979.

B.A., Natural Sciences, Cambridge University, 1976

Summary

Evolutionary history and local environmental conditions predict the distribution of species and communities on land and this underpins landscape management. The Marine Biodiversity Hub's aim is to provide a similar predictive capacity for Australia's seascape. The Hub will build research capacity and collaboration between marine research agencies, and provide new tools to support the identification, assessment, conservation and sustainable use of Australia's marine assets, including enhancing the National Representative System of Marine Protected Areas (NRSMPA) and other ESD management applications. This will assist conservation agencies, resource management agencies, and users to develop management approaches that provide comprehensive, adequate and representative conservation of Australia's seascape. Hub outputs will help agencies and stakeholders meet the requirements of the NRSMPA, *Environmental Protection and Biodiversity Conservation Act*, the Commonwealth Fisheries Act, and various State Fisheries and Conservation Management legislation.

The Marine Biodiversity Hub is specifically organised to combine the resources, talents and knowledge of the five partners – University of Tasmania, CSIRO, Geoscience Australia, Australian Institute of Marine Sciences and Museum Victoria – to deliver a common understanding and a common suite of spatial and non-spatial tools for the conservation management of marine resources.

Four multi-institutional research projects form the basis of the hub, with a fifth project devoted to stakeholder engagement and outreach. The four research projects and their leaders are:

Biodiversity (Dr Alan Butler, CSIRO): determines patterns in Australian marine biodiversity at continental, regional and local scales using taxonomic and genetic approaches.

Surrogates (Dr Brendan Brooke, GA): determines utility of marine biophysical variables as surrogates for benthic habitats and patterns of marine biodiversity.

Prediction (Dr Roland Pitcher, CSIRO): develops models that predict patterns of marine biodiversity with specifiable precision.

Management Tools (Dr Chris Wilcox, CSIRO): develops and tests biodiversity conservation approaches, including incentives and offsets, that complement the NRSMPA.

CERF Research Hub

Name

Taxonomy Research & Information Network (TRIN)

Australian Government Funding

\$6.05 million

Principal Research Leader

Name: Dr Judy West

Position: Director

Institution: Centre for Plant Biodiversity Research, CSIRO Plant Industry

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Dr Judy West is Senior Principal Research Scientist of CSIRO Plant Industry and Director of the Centre for Plant Biodiversity Research and Australian National Herbarium. She has an adjunct Professor appointment at Australian National University. For her contributions to Australian plant systematics Judy was awarded the Nancy Burbidge Memorial Medal in 2001 and an Order of Australia in 2003. Her scientific expertise is in plant systematics and phylogenetics, bioinformatics and conservation biology. Her research centres on understanding plant classifications and evolutionary histories of the Australian flora; her influential role in plant systematics has helped shape the philosophy and technological approach and development of the discipline. Judy pioneered the application and adoption of modern information technologies to deliver results of taxonomic research to a broader user community.

Summary

The Taxonomy Research & Information Network (TRIN) addresses critical knowledge gaps in key Australian animal and plant groups important for effective environmental management.

Broad goals:

- reinvigorate taxonomy within Australia
- evaluate new methodologies for research and delivery of taxonomic information for a wide range of end-users, and
- create a modern collaborative national electronic framework for taxonomy.

TRIN will accelerate description, documentation and understanding of Australian biodiversity.

Research focuses around four significant target groups lacking taxonomic expertise in Australia; each project area has a newly appointed early career scientist, technical support and postgraduate students:

Ants: focus on three large ant genera increasing taxonomic knowledge through morphology and molecular studies; collaborations of ant workers across the country, capitalizing on existing expertise;

Mayflies and other aquatic macroinvertebrates: focus on documentation and taxonomy of key freshwater genera such as mayflies; DNA barcoding used for identification and to link different life history stages;

Weeds of National Significance (WONS): selected species complexes requiring control strategies; initial focus on willows and lantana; using molecular techniques and population genetic analyses;

Small Terrestrial Vertebrates: identification of cryptic species in widespread taxa; threatened taxa; DNA analyses assist with understanding original genetic structure and enable targeting surviving populations;

Information Management Supporting Taxonomy: taxonomic information management infrastructure to support research and information delivery of projects, using contemporary biodiversity information standards and protocols.

Outputs include scientific publications, novel web-based applications and identification tools. Web-based interactive keys to Australian insect families will provide a single portal and interface for identification beyond its funded research projects, the taxonomy hub aims to catalyse collaboration on national taxonomy research projects facilitated by modern information management and communications technology. Data from TRIN will contribute to national biodiversity information projects such as the Atlas of Living Australia.

Knowledge brokers are working with end-user communities to assist information discovery and translation of complex taxonomic information into practical applications. New taxonomic data, an enhanced taxonomic information framework and a cohort of newly trained taxonomists will help to build Australia's capability.

CERF Research Hub

Name

Environmental Economics Research Hub

Australian Government Funding

\$7 million

Principal Research Leader

Name: Professor Jeff Bennett

Position: Director

Institution: Crawford School of Economics and Government,
Australian National University

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Web site: www.crawford.anu.edu.au/research_units/eerh/index.php



Professor Jeff Bennett has over 30 years experience researching, consulting and teaching in the fields of Environmental Economics, Natural Resource Economics, Agricultural Economics and Applied Micro-Economics. He is currently leading research projects investigating the use of non-market techniques to estimate the value of the environment, the allocation of water in coffee growing regions in Vietnam, land use change in the north west of China and private sector conservation initiatives. Jeff was President of the Australian Agricultural and Resource Economics Society in 2004 and is currently co-editor of the Australian Journal of Agricultural and Resource Economics. He is Principal of the consulting group, Environmental and Resource Economics.

Summary

The goal of the Environmental Economics Research Hub is to address Australia's major environmental management challenges with integrated economic research that provides immediate and continuing policy impacts. It brings together leading environmental economists, scientists, educators and policy makers to face the challenges of sustainable water use, soil loss and salinity, biodiversity loss and adaptation to climate change. The Hub's integrated research, modelling and capacity-building encompasses four key themes: the establishment of markets to achieve environmental goals; environmental valuation; adaptation to climate change and the assessment; and development of government intervention in environmental management. It will provide end users with the tools, understanding and framework to promote environmental sustainability in Australia.

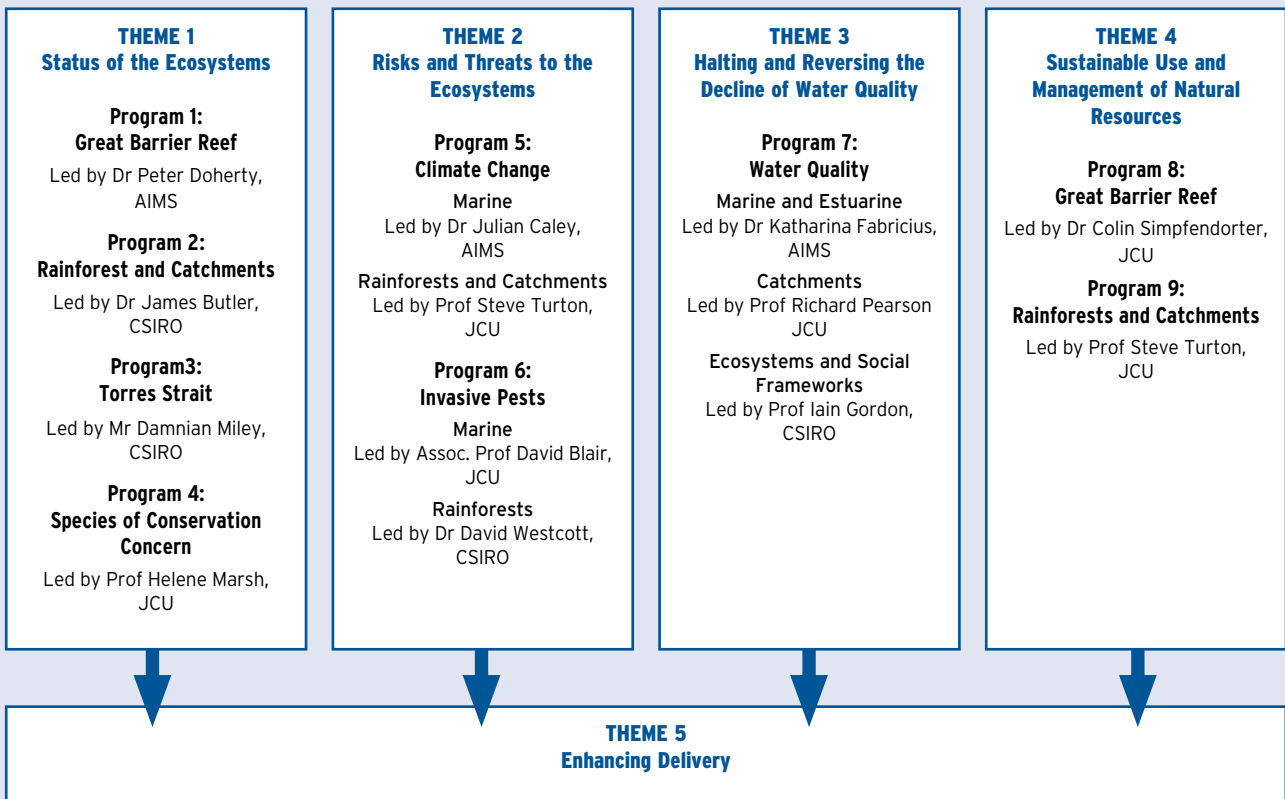
Fourteen projects form the core of the Hub:

- consumption-based water pricing (Prof Grafton/ANU)
- estimating environmental protection values at general and case study levels (Prof Rolfe/CQU)
- economically efficient strategies for biodiversity conservation (Dr Ward/ANU)
- designing metric assessments for biodiversity tenders (Prof Rolfe/CQU)
- designing marine reserves for biodiversity and sustainable fisheries (Prof Grafton/ANU)
- environmental values and valuation over time (Prof Bennett/ANU)
- integrating community preferences into vegetation planning (Prof Bennett/ANU)
- divergence between community and expert valuations (A/Prof Burton/UWA)
- salinity, uncertainty and property rights (Prof Fox/UNSW)
- adaptation and economic responses to climate change (Dr Jotzo/ANU)
- improving energy efficiency (Dr Pezzey/ANU)
- socio-economics of on-farm renewable energy (Prof Hundloe/Griffith U)
- designing environmental policy for Australia (Dr Betz/UNSW), and
- the benefits and costs of bio-security (Dr Kompas/ANU).

Marine and Tropical Sciences Research Facility

The Marine and Tropical Sciences Research Facility (MTRSF) is the largest of the national network of environmental research hubs funded through the Commonwealth Environmental Research Facilities (CERF) program. It was created in May 2005 following the Australian Government's decision to invest in public good scientific research supporting the conservation and sustainable use of the high-value environmental assets of north Queensland.

MTRSF – Themes and Programs



Marine and Tropical Sciences Research Facility

Goals and research strategy

“Ensuring the health of north Queensland’s public environmental assets – particularly the Great Barrier Reef and its catchments, tropical rainforests including the Wet Tropics World Heritage Area, and the Torres Strait – through the generation and transfer of world-class research and sharing knowledge.”

To achieve its vision, the MTSRF has planned, funded and coordinated the highest-quality, cross-disciplinary research for public good, to:

- ensure the protection, conservation, sustainable use and management of the environmental assets of the Great Barrier Reef and its catchments, tropical rainforests including the Wet Tropics World Heritage Area and the Torres Strait
- foster an understanding of the interactions of north Queensland’s natural environment with the social and economic aspects of north Queensland’s communities
- support the adoption of science-based knowledge in policies and practices for ecologically sustainable management, and
- facilitate capacity-building for sustainable environmental management and environmental management research, in partnership with the community, environmental managers, research institutions, industry and policy-makers.

The MTSRF’s Research Investment Strategy guides investment across five major themes: Status of the Ecosystems, Risks and Threats to the Ecosystems, Halting and Reversing the Decline of Water Quality, Sustainable Use and Management, and Enhancing Delivery.

The MTSRF investment is managed by the Department of the Environment, Water, Heritage and the Arts (DEWHA) and is administered in north Queensland by the Reef and Rainforest Research Centre Limited (RRRC).



Marine and Tropical Sciences Research Facility

Theme 1 – Status of the Ecosystems: understanding the condition, trend and interdependencies of the environmental assets of north Queensland.

It is important that government, natural resource managers, protected area managers, industry and the Australian and international communities have a clear understanding of the state of north Queensland's key environmental assets. It is important to foster sustainable use by the industries reliant on these environmental assets to support ongoing management of the assets and to help inform policy direction both for north Queensland and nationally.

To achieve this, MTSRF will produce world-class reports on the state of key assets, identifying possible threats, the socio-economic values of the assets and, importantly, cost-effective methods for longer-term assessment.

Program 1 – Great Barrier Reef (GBR)

Program Leader: Dr Peter Doherty, Australian Institute of Marine Science

The program will focus on delivering robust indicators of reef health and identifying thresholds of potential concern for the GBR ecosystem. The program also contains two long-term monitoring programs of iconic ecosystems (coral reefs and seagrasses).

Program 2 – Rainforests and Catchments

Program Leader: Dr James Butler, CSIRO Tropical Forest Research Centre

Program 2 will continue to report on the condition and trend of key environmental assets, including ecosystem processes and biodiversity, in the Wet Tropics rainforests and catchments. This program will collate and evaluate current knowledge on biodiversity and provide further data on targeted gap-filling and the baseline data for comprehensive condition monitoring and reporting of north Queensland's rainforest environmental assets.

Program 3 – Torres Strait

Program Leader: Mr Vic McGrath, Torres Strait Regional Authority

Program 3 will concentrate its resources on establishing key background knowledge and models of the status, use and trends of Torres Strait ecosystems to enable predictive power and management strategy evaluation in the future. The program is divided into two sub-programs: Status, Trends and Use which covers both the Great Barrier Reef and Torres Strait nodes of MTSRF; and Marine species of conservation concern, information from which will contribute to an Integrated Report Card. Development of the Report Card is to be combined across the Torres Strait and Great Barrier Reef "Status and Trends" programs, the "Ecosystems and Social Frameworks" Program in the Water Quality Node and the Rainforest Node.

Program 4 – Species and communities of conservation concern

Program Leader: Professor Helene Marsh, James Cook University

This program harnesses the expertise of researchers from James Cook University and Queensland's Environmental Protection Agency together with Indigenous local experts to conduct world class, multidisciplinary problem-focused research. This research will enhance the scientific information required to develop effective management strategies for the populations of marine species of conservation concern that occur in the Great Barrier Reef World Heritage Area and Torres Strait. The particular species of concern include dugongs, marine turtles and marine turtle habitats, and the research priorities have been determined in consultation with the key end user groups. Research results are being communicated via TSRA and the Cape York Land Council.

Marine and Tropical Sciences Research Facility

Theme 2 – Risks and Threats to the Ecosystems

Early identification of risks and threats to north Queensland's key environment assets, and early advice on options to mitigate and better manage threats, are critical to the future environmental, economic and social underpinning of north Queensland. In particular, options for mitigating and adapting to climate change, increased climate variability and invasive species have been identified as key priorities for north Queensland. It is anticipated that results from Theme 2 will contribute to prediction of impacts, sources of resilience and importantly, practical responses to threats and their mitigation.

Program 5i – Climate Change: Great Barrier Reef

Program Leader: Dr Julian Caley, Australian Institute of Marine Science

Program 5i addresses specific information gaps of direct relevance and importance to users of the Great Barrier Reef and those charged with its sustainable management. The Program will address high priority issues for climate change impacts on the Great Barrier Reef including an evaluation of possible futures for the ecosystem of the Reef based on present knowledge and forecasted climate variations; an early warning and assessment system for thermal stress on the Reef; an evaluation of the resilience of coral reef ecosystems to climate change; and tools to support resilience-based management in the face of climate change.

Program 5ii – Climate Change: Rainforests and Catchments

Program Leader: Professor Steve Turton, James Cook University

Program 5ii is focussing on delivering strategic knowledge about the impact that climate change is having and will have on north Queensland's tropical forests, and management options for mitigation. It will provide early identification of the risks and threats posed by climate change to north Queensland's key terrestrial environmental assets and early advice on the resilience or lack of resilience of different terrestrial ecosystems and biodiversity.

The Program is developing improved regional scenarios and understanding of future climate change relevant to North Queensland's tropical forests, such as increased temperature in mountainous areas, changes in patterns of rainfall, clouds, extreme weather events and CO₂ dynamics. It will also assess the potential of Wet Tropics vertebrates to adapt to predicted future climatic changes and predict the risk of extinction due to climate change.

Program 6 – Invasive Pests

Program Leaders: Dr David Westcott, CSIRO Sustainable Ecosystems and Dr David Blair, James Cook University

Program 6 will report on the current and potential risks and mitigation of invasive marine species in the Great Barrier Reef through a desktop study based on published and grey literature. The program will also develop a set of protocols for translocation of genetic material within the Great Barrier Reef to minimise the risks of genetic contamination based on current understanding of the spatial structure of Great Barrier Reef populations. The program will also develop a rapid response strategy to incursion by detailing ecological dispersal traits (e.g. introduction history, distribution, abundance, taxonomy, population parameters, reproduction, environmental tolerances, habitat preferences, movement, feeding habits), and a statement of current or potential impact of native and exotic species.

Theme 3 – Halting and Reversing the Decline of Water Quality

Water quality is vital to the ongoing health of the Great Barrier Reef and its catchments, the Wet Tropics rainforests, and for the communities, industries and ecosystems that rely on good water quality to survive.

Program 7 – Water Quality

Program Leaders: Dr Katharina Fabricius, Australian Institute of Marine Science; Professor Richard Pearson, James Cook University; and Professor Iain Gordon, CSIRO Sustainable Ecosystems

The quality of water entering the Great Barrier Reef lagoon has been declining and is negatively affecting the condition of its ecosystems. There is an urgent need to elevate our certainty about the effectiveness of actions taken under the Reef Water Quality Protection Plan (Reef Plan) and Reef Rescue Plan, and for improved scientific understanding of the links between terrestrial processes and the condition of freshwater, estuarine and marine ecosystems.

Marine and Tropical Sciences Research Facility

The main objective of this Theme is to identify robust indicators for water quality in freshwater, estuarine and marine ecosystems, to improve water quality specific monitoring, and to determine pollutant thresholds of potential concern for bioindicators. This information will be integrated with economic and social drivers of land-use management that influence water quality, and will form a significant part of the water quality reporting under the Reef Plan.

Theme 4 – Sustainable Use and Management of Natural Resources

Sustainable use of north Queensland's natural assets is critical to maintaining the environmental, social and economic values of the region. The research to be undertaken will provide knowledge and options for promoting sustainable use and minimising adverse impacts on these natural assets.

Program 8 – Great Barrier Reef

Program Leader: Dr Colin Simpfendorfer, James Cook University

The reef component of the research program will provide strategic research directions for the sustainable use and management of the biodiversity and natural resources of the Great Barrier Reef (GBR) with respect to ecological, social and economic sustainability. The research will occur in areas throughout the GBR, involving large-scale, integrated projects of a multi-disciplinary and collaborative nature, and involving the key end users.

Program 9 – Rainforests and Catchments

Program Leader: Professor Steve Turton, James Cook University

The rainforest program is focused on sustainable use, planning and management of north Queensland's tropical rainforests and adjacent 'Wet Tropics' altered and urbanised landscapes that constitute significant catchment areas for the Great Barrier Reef. The main objective is to provide the knowledge base that supports the management of the Wet Tropics World Heritage Area, as well as supporting sustainable economic activities (notably agriculture, agroforestry, tourism and Indigenous enterprises), while enhancing biodiversity and maintaining essential ecosystem services across the entire Wet Tropics landscape.

Theme 5 – Enhancing Delivery

In order for MTSRF to achieve its goals, there must be a major focus on enhancing delivery of scientific information such that end users incorporate it into increasingly sustainable management, policy and practice. The Reef and Rainforest Research Centre Ltd (RRRC) is responsible for Theme 5 of MTSRF, and in this knowledge broker role RRRC is charged with synthesising, packaging and delivering strategic scientific information to targeted end users.

The broad objectives of activities and projects in Theme 5 are:

- to facilitate increasingly sustainable management of the region by enhancing delivery of scientific information to end users
- to facilitate cooperation and collaboration within MTSRF and between MTSRF, other research providers, and end users, to enhance the capacity for sustainable, informed management of the region, and
- to raise awareness and demonstrate the value of the MTSRF to targeted stakeholders and end users.

For further information on MTSRF contact:

Reef & Rainforest Research Centre
Sheriden Morris; Managing Director
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www.rrrc.org.au
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CERF Significant Fellowships and Projects

Fellowships



Professor Gene E. Likens (Institute of Ecosystem Studies, Millbrook, NY)
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Host: Australian National University (ANU)
Dr David Lindenmeyer
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Developing a basis for a Long Term Ecological Research (LTER) network in Australia and a systematic approach to environmental monitoring

Many countries worldwide have established Long Term Ecological Research Networks (LTER's). These are critical to collecting key ecological data and monitoring and reporting the impacts of environmental change. Australia has a small informal network of just six voluntary LTER sites and no formal LTER network. This creates many major deficiencies in Australia's environmental management and environmental reporting. Gene has been a world leader over many decades in longterm ecological research and environmental monitoring. He will help identify the key components needed to develop a world-class LTER program for Australia and also provide advice on what is required for the development of an informed and effective environmental monitoring framework in Australia.



CERF Significant Fellowships and Projects

Fellowships



Dr Reginald Watson (University of British Columbia, B.C.)
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Host: University of Tasmania
Stewart Frusher
stewart.frusher@utas.edu.au

Ecosystem model analysis to address fisheries management issues in south eastern Australia and the implications of climate change

Commercial and recreational fisheries and marine ecotourism (e.g. diving, marine mammals) provide significant social and economic contributions to Australian coastal communities. Impacts, such as climate change, can alter the productivity of marine ecosystems and consequently pose significant threats to industries and communities dependent on sustainable use of marine resources. This fellowship brings together expertise from some of the world's leading marine ecosystem modelling groups to assemble existing datasets across different Institutions, with the aim of developing and adapting ecosystem models for the Australian marine environment. This will lead to enhanced skills in management of our marine resources.



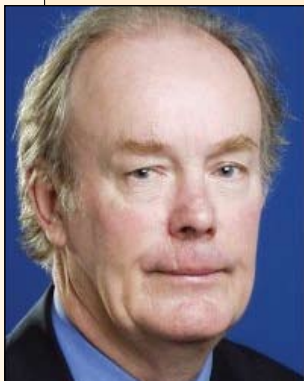
Emeritus Professor Gordon Grigg (University of QLD) and
Dr Andrew Taylor (University of NSW)
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Development of an autonomous (acoustic) biodiversity monitoring system

This project has the potential to revolutionise biodiversity monitoring. Our proposal is to build on the current system and develop a new bioacoustic monitoring system which is readily deployable by non-technical users and has a much broader acoustic scope: including birds, bats, insects and any other acoustically active animal. The 'new' system will be able to be deployed 'naïve' into any acoustic environment. Using sophisticated software which we will develop, the system will automatically categorise a structured but unlabelled library of sounds for efficient post hoc identification and labelling. The system will be able to monitor a substantial part of biodiversity 365/24/7, solar powered, for either repaid assessment or long term monitoring, and even at remote locations where a choice could be made between either annual download visits or via direct linkage in real time via wireless broadband or satellite.

CERF Significant Fellowships and Projects

Fellowships



Professor Philip (Sam) Lake
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Monash University

Drought and aquatic ecosystems: impacts and responses

Drought is a normal component of climate, especially in Australia. Drought research has centred on climatic, meteorological and hydrological aspects along with impacts on agricultural and social systems. Research on the impacts of drought on aquatic ecosystems (freshwater, inland and estuarine) has been neglected. There is scattered literature on the effects of drought on aquatic ecosystems: species, communities and ecological processes.

The aim of this project is to review the literature on impacts of drought on aquatic ecosystems, and to integrate this with the climatological, meteorological and hydrological knowledge of drought.



Dr Stephen Hamilton (Michigan State University, USA)
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Host: Griffith University
Professor Stuart Bunn
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Waterholes in a changing climate: hydrological vulnerability and implications for ecological services and cultural values

Waterholes are critical refugia for aquatic biodiversity in dryland rivers and are highly valued by local communities, yet are vulnerable to increasing water demands and effects of climate change. This study of hydrological and ecological features of waterholes across the tropics seeks to understand how they would respond to these pressures. It builds on research conducted in the Lake Eyre Basin, augmented with remote sensing and water level monitoring, and would complement work undertaken by Australian researchers in the TRaCK hub. Results will help establish priorities for conservation and management of these important ecosystems.

CERF Significant Fellowships and Projects

Projects



Professor Ary Hoffmann
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Predicting and monitoring climate change in insects: from genes to distribution shifts

We need methods to effectively predict the risk of invasions of health/agricultural pest organisms, and the risk of extinction of threatened organisms, if we are to mitigate future changes in climate. We will use insects from threatened habitats and *Aedes* mosquitoes (vectors of dengue fever) to implement a new approach for predicting the future distribution of key species with climate change. Our approach links genetic markers and GIS data with powerful new mechanistic models that allows us to predict the impact of both evolutionary potential and changed human behaviour on the future distribution of species.



Dr Graham Edgar
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Volunteer monitoring of the state of Australian rocky reef communities

An urgent need exists to document coastal biodiversity in a systematic way. Huge changes are occurring in inshore habitats due to fishing, sedimentation, coastal development, pollution, climate change, and species introductions; however, very little reliable information exists on the scale and consequences of these threats. Such information is particularly crucial to management agencies if they are to act most appropriately in allocation of resources and in decision making. We propose to develop and resource a network of skilled recreational divers who can rapidly and cost-effectively assess the state of the inshore marine environment at the continental scale using standardised methods.



Professor David Bowman
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University of Tasmania

Using tree rings of an Australian conifer as a bio-indicator of decadal-scale environmental change

Ecological responses to climate change remain very uncertain, especially in outback Australia. We will study the population growth of an Australia-wide native conifer (*Callitris columellaris*). Field surveys, tree ring measurements and stable isotopic analyses will: (i) chronicle historical patterns of landscape change; (ii) rank the importance of land-use and climate in driving these changes; (iii) improve understanding of the ecology of the 'greenhouse effect', thus assisting national carbon accounting; and (iv) create new climate data for the last 200+ years, significantly adding to sparse climate records, and the understanding of past climate variability and extreme events in outback Australia.

CERF Significant Fellowships and Projects

Projects



Professor Stephen Dovers
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Australian National University

Sustainable Farms: Future pathways for rural landscapes

Sustainable Farms focuses on the long-term ecological integrity and productivity of rural landscapes, adding policy and social dimensions to innovative ecological research. Interdisciplinary and applied, it will investigate the (1) ecological sustainability of alternative farming approaches, (2) viability of alternative policy and institutional options, and (3) congruence of these with the values held by key stakeholders. Unlike most current thinking, the focus will be on the multi-decadal spans of key social and ecological processes. Outstanding early-career researchers will be guided by accomplished senior researchers. The new insights

generated will be directly relevant to the development of policy innovations.



Professor David Pannell
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University of Western Australia

INFFER: Investment Framework For Environmental Resources

This project is about bridging science, economics and policy for improved environmental management. The team is internationally recognised for its research, and has an outstanding track record of linking research to policy to enhance NRM outcomes. The research will advise policy makers and environmental managers on investment strategies to maximise public net benefits from program expenditures, including policy mechanism choice and the prioritisation of investments. The focus will be on water quality, biodiversity, and pest plants and animals. The project complements (and will

work with) existing CERF hubs by providing a policy focus, and by strengthening their access to economic and social expertise.



Dr Darren Baldwin
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Murray-Darling Freshwater Research Centre

Determining watering regimes to protect floodplains under hyperdrought conditions

Floodplains in semi-arid regions rely on periodic floods to maintain soil health - a key driver of ecosystem condition. River regulation and overextraction of water resources has limited the frequency of small to medium floods, imposing a long-term artificial drought regime that has substantially impacted on floodplain condition. Because these floodplains are already stressed due to low soil moisture, they become more susceptible to drought-induced degradation than they would be under natural flow regimes (hence the term 'hyper-drought').

This project will determine critical thresholds for maintaining soil health and ecological function. The knowledge generated can be used as ecological targets for restoration of these degraded ecosystems, and is of critical importance in the face of climate change.

CERF Significant Fellowships and Projects

Projects



Dr Graham Marshall
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University of New England

Improving economic accountability when using decentralised, collaborative approaches to environmental decisions

Decentralised approaches to environmental governance emphasising collaboration between interested parties have become popular in Australia in recent years. These approaches recognise that the social-ecological systems of concern are typically complex adaptive systems, rather than mechanistic systems amenable to conventional benefit-cost analysis. Nevertheless, economic accountability in these approaches remains vital for ensuring available resources are allocated optimally. The project focuses on the social and economic aspects of our environment benefit cost analysis issues, and governance of the commons, and will use action research involving key local environmental decision-makers and end-users. The research will identify, test and propose cost-effective methods for enhancing economic scrutiny of collaborative environmental decisions.



Dr Samantha Setterfield
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Charles Darwin University, Darwin

Optimising weed risk management investment through improved spatial distribution and benefit cost analysis modelling

Weed management informed by an assessment of risk is recognised as best practice in Australia (as evidenced by the Post-Border Weed Risk Management (WRM) protocol (Virtue et al. 2007)). The adoption of a risk assessment based approach provides a strategic framework for mitigating the threats posed by weeds. However optimal performance of such frameworks is limited by two key knowledge gaps: decision support tools for assessing benefit-cost and the ability to model potential distribution and weed spread. Both of these deficiencies reduce the ability of natural resource managers to make informed decisions about the risk posed by different weeds and hence to prioritise investment in weed management. This project is one of four linked projects that form a program of R&D activities to develop the decision support tools needed to address these gaps. The alignment with a national WRM approach and links to existing regional and cross-jurisdictional R&D ensures that outputs from this project are relevant and will have excellent end-user uptake.

CERF Significant Fellowships and Projects

Projects



Assoc Prof Nathan Bindoff
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Antarctic Climate and Ecosystems CRC

Climate futures for Tasmania: prospects, impacts and information for adaptation options

Climate futures for Tasmania will inform diverse stakeholders about likely impacts of climate change on conditions that are important for their decision making and operations. We will produce fine scale (approximately 10-15 km resolution) climate projections for Tasmania under a range of accepted greenhouse case emission scenarios. Outputs will be tailored to produce information stipulated by stakeholders to be most important to their activities.

Analysis will be focussed in three main areas of climate futures: a) water status in catchments and reservoirs; b) normal, average climate conditions; and c) extreme events, including high winds, flooding, and coastal inundation.



Dr Elaine Barclay
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Order with and without law: understanding perceptions and attitudes towards formal and informal controls of environmental resource transgressions

Environmental benefits are threatened, and dire environmental risks posed, by high land clearance rates and the theft or misuse of water resources in Australia. Criminalisation of unauthorised clearance of native vegetation or extraction or misuse of water has been met by non-compliance and active social resistance. A survey of farmers and case studies in Queensland, NSW and Victoria will identify and compare prevailing perceptions, social norms and informal sanctions pertaining to various environmental transgressions. The outcomes will provide a universal, best-practice model to guide future policy and programs (government and community) to bolster community capacity for self-governance of NRM issues.

Further information

Commonwealth Environment Research Facilities (CERF)
Department of the Environment, Water, Heritage and the Arts

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Please check our web site
www.environment.gov.au/cerf

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Credits: Cover: Map – Satellite Image compiled by ERIN Department of the Environment Water Heritage and the Arts supplied by CSIRO 1994; Regeneration, Department of Foreign Affairs and Trade – Overseas Information Branch; Lizard Island and surrounding reef, Department of Foreign Affairs and Trade – Overseas Information Branch (also P4, P14); Barmah Forest in flood, Trevor J Lerino (also P5); Butterfly fish, Robert Thorn (also P13); Man walking, Department of the Environment Water Heritage and the Arts; Inside cover: Wet tropics of Queensland, Colin Totterdel; P2: Bracket Fungus, John Baker; P4: Gondwana rainforest of Australia, Paul Candlin; P5: Selection of rainforest fruits, Wet Tropics Management Authority; P13: Hill inlet in the Whitsundays, Michael Jensen (DFAT); Whale, Dave Paton; Golden Orb Spider, Wet Tropics Management Authority; Mahogany Glider, Wet Tropics Management Authority.