

Environmental Prediction Symposium:

New horizons for future-focused science and application

4–5 June 2019 | National Museum of Australia, Canberra

Program



Starfish Hill Wind located in grazing land near Cape Jervis, South Australia [Image courtesy of Christine Painter]

Program

TUESDAY 4 JUNE 2019 – MC – Rebecca Pirzl		
9:30 - 10:00	Welcome to Country Symposium opening	Wally Bell , Buru Ngunawal Jane Coram , Director CSIRO Land and Water
10:00 - 11:00	Session 1: Opening Plenary Keynote presentations on key topics in environmental prediction and highlighting the need to direct our science and decisions more explicitly toward the future.	Chair: Dr Rebecca Pirzl, CSIRO
	Mark Crosweller AFSM <i>Resilience and vulnerability: Two sides of the same coin</i>	Head, National Resilience Taskforce
	Dr Beth Fulton <i>What an exciting time to be a modeller!</i>	CSIRO
11:00 - 11:30	<i>Morning tea</i>	
11:30 - 13:00	Session 2: The need for prediction science Focusing prediction science efforts to achieve impact and benefit for society requires an understanding of the diversity of actors and their needs, motivations and benefits. Users, beneficiaries and customers of prediction science will provide their perspectives through a number of sectoral lenses.	Chair: Warwick McDonald, CSIRO Format: Three speakers discuss how environmental prediction could help them overcome key challenges. Zeetings session will explore key questions to bring an end-user perspective to symposium science deliberations.
	Professor Rob Vertessy	University of Melbourne
	Dr Jillian Edwards <i>Beyond Business as Usual</i>	National Resilience Taskforce
	Dr Beth Brunoro	Department of Energy and Environment
13:00 - 14:00	<i>Lunch</i>	
14:00 - 15:30	Session 3: Future and problem framing Diverse approaches for exploring environmental futures, multidisciplinary perspectives on uncertainty and risk, and future ready problem-framing and objective setting.	Facilitators: Dr Deb O'Connell and Dr Nicky Grigg, CSIRO Format: Three speakers followed by group discussions.

	Dr Mark Stafford-Smith <i>Framing complex social-ecological futures</i>	CSIRO
	Professor Gabriele Bammer <i>Disciplining Interdisciplinarity and Embracing Unknowns</i>	The Australian National University
	Dr Michael Dunlop <i>Environmental prediction through the lens of transformational adaptation</i>	CSIRO
15:30 - 16:00	<i>Afternoon tea</i>	
16:00 - 17:30	Session 4: Information infrastructure for prediction science Assessing the information infrastructure (technical, information and social) needs of prediction science, current capabilities and identifying solutions to fill gaps.	Facilitator: David Lemon, CSIRO Format: Four short talks on aspects of infrastructure followed by group discussion focused on meeting needs.
	Dr Andre Zerger <i>Connecting data infrastructure with prediction systems – opportunities and challenges</i>	CSIRO
	Sarah Richmond <i>ecocloud: connecting an ecosystem of infrastructure for environmental research and decision-making</i>	Griffith University
	Matt Paget	CSIRO
	Dr Adrian Burton	Australian Research Data Commons
17:30 - 19:30	<i>Drinks, canapes and networking</i>	

WEDNESDAY 5 JUNE 2019 – MC – Veronica Doerr

9:00 – 10:30	Session 5: Modelling for prediction science Understanding the current modelling capabilities of environmental prediction science both within and across domains.	Facilitator: Dr Cameron Fletcher, CSIRO Format: Three speakers followed by group discussions on focal topics.
	Dr Steven Lade <i>Regime shifts and resilience in social-ecological systems</i>	Stockholm Resilience Centre
	Dr Carmel Pollino	CSIRO
	Dr Andrew Rendall <i>ISAM: At the frontier of integrated modelling capabilities</i>	CSIRO
10:30 - 11:00	<i>Morning tea</i>	
11:00 - 12:30	Session 6: From prediction science to application Building a knowledge base for decision makers and practitioners to support more future-focused decision-making relies on new science to understand how to link science and application. These include co-design and co-production of research; the quality of process as well as outcome; strategic decision-making processes that consider multiple criteria and better address uncertainty; and ways to bridge organisational cultures. This session addresses the characteristics of science for impact in the environmental prediction domain.	Facilitator: Dr Heinz Schandl, CSIRO Format: Three speakers followed by group brainstorming aimed at integrating the solutions to these challenges into all aspects of prediction science.
	Louise Freebairn <i>Co-producing knowledge using participatory modelling for complex, policy questions</i>	ACT Health
	Dr Russ Wise	CSIRO
	Dr Steve Cork	The Australian National University
12:30 - 13:30	<i>Lunch</i>	

13:30 - 15:00	<p>Session 7: Team challenge</p> <p>Given what we heard at the start of the symposium about the need for prediction science, how would you combine leading-edge science in problem framing, information infrastructure, modelling, and bridging science into application in order to provide new predictive solutions?</p> <p>Format: Symposium participants will work together across the four themes discussed in the symposium to use what they have learned to develop a plan to meet a specific application challenge. They will brainstorm and then ‘pitch’ their approach to the whole group to vie for a coveted prize.</p>	<p>Facilitator:</p> <p>Dr Veronica Doerr, CSIRO</p>
15:00 - 15:30	<p>Session 8: Symposium synthesis</p> <p>Reflections on the two days, emphasising what we have learned and what we will take forward.</p>	<p>Facilitator:</p> <p>Dr Veronica Doerr, CSIRO</p>
15:30 - 16:00	<i>Afternoon tea</i>	
16:00	<i>Close</i>	

Biographies and abstracts

Wally Bell

Wally Bell is a Ngunawal man and an Elder of his clan group, the Yharr. Wally holds a Cert III in Business Management and a Cert III in Conservation and Land Management. Wally holds positions on:

- Buru Ngunawal Aboriginal Corporation
- Mulanggang Traditional Aboriginal Landcare Group
- Namadgi Rock Art Working Group
- Tidbinbilla Strategic Board of Management
- Representative Aboriginal Organisation for ACT Governments Heritage Unit
- Landcare ACT.

Wally is actively participating in all aspects of Aboriginal cultural heritage and land management for the area that lies within his tribal boundary and engages with the wider community on developing an awareness of local Aboriginal culture.

Jane Coram

CSIRO

Jane Coram's career in natural resources science delivery spans nearly 30 years. It has focused on applying scientific solutions to natural resources management challenges, particularly in relation to groundwater and groundwater-dependent ecosystem management. Her experience and technical knowledge spans a range of issues including coal seam gas, coal and unconventional energy resources, uranium mining and radioactive waste disposal, groundwater sustainability, dryland salinity, groundwater-surface water dynamics; forest ecology and management; reserve design and biodiversity management.



With formal qualifications in hydrogeology and earth sciences, Jane has a broad multidisciplinary understanding of land and water sciences. She is Director of CSIRO's Land and Water Business Unit, and has also held senior leadership positions including as Acting Chief Scientist and leader of the groundwater capability at Geosciences Australia, and Chief Executive of the National Measurement Institute.

Session 1 – Opening Plenary

Mark Crosweller AFSM

National Resilience Taskforce

Mark Crosweller is the Head of the National Resilience Taskforce within the Department of Home Affairs. In this role, Mark is responsible for leading nation-wide reforms to disaster mitigation and resilience policy, to reduce the impact disasters have on Australian communities and the economy. Mark has liaised extensively at the national level across governments, NGOs and the private sector to develop the National Disaster Risk Reduction Framework which guides national effort to reduce climate and disaster risk. He is overseeing key

initiatives to implement the Framework. These include a pilot project to explore the feasibility of establishing a new national climate and disaster risk information capability for Australia, strategic guidance to ensure climate and disaster risks inform decisions in the face of growing complexity, and a new report 'Profiling Australia's Vulnerability' which re-thinks our approach to disaster, whatever the threat or shock.



Mark has 34 years of experience as a senior executive, practitioner, advocate, strategist and policy maker in the areas of crisis, disaster and emergency management, mitigation and resilience. Before joining the Commonwealth Government Mark had a distinguished career in emergency services, commencing as a fire fighter and progressing through the ranks to become the Commissioner for Emergency Services within the Australian Capital Territory Government. During this period Mark led, directed and managed, at both the strategic and operational level, key aspects of many of Australia's most significant disaster events including the 2003 Canberra Fires, the 2009 Victorian Fires, the 2011 Queensland Floods, the 2013 ex Tropical Cyclone Oswald, the 2016 Cyclone Debbie as examples.

Mark's extensive career spans across the private sector as well as local, state, territory and federal governments. During this time Mark has led large and diverse workforces at division, group and agency level in all aspects of strategy, operations and corporate governance.

Abstract

Resilience and Vulnerability: Two Sides of the Same Coin

Resilience is often (rightly) championed as a key strategy for managing the inevitable impacts of natural hazard events. However, without balancing efforts in resilience with efforts in risk reduction, resilience will become increasingly difficult to achieve and sustain. This presentation will explore the implications of 6 emerging key strategic drivers and what they mean for long term risk reduction in a national policy context and in turn what they might mean for science.

Dr Beth Fulton

CSIRO



Dr Beth Fulton is a Principal Research Scientist with CSIRO Oceans and Atmosphere where she leads the Marine Ecosystem Modelling and Risk Assessment Group. Beth is also an Adjunct Professor at the Centre of Marine Socioecology, University of Tasmania. Beth has been with the CSIRO for the past 18 years, where she and her group have developed various system modelling tools for looking at marine ecosystems, sustainability and adaptation to global change.

Abstract

What an exciting (terrifying) time to be a modeller!

For generations environmental prediction (biophysical and ecological modelling) has centred on the main scales we humans live at - the population to regional landscape scale that typify 'ecosystem scale'. This has

seen the models focus on the mechanisms shaping the spatial and temporal patterns characterising these ecosystems. It can be argued that over the last 20 years in particular modellers had become relatively comfortable with the capacity to model these scales, though there was still a lot of devil in the detail at the margins. However, the new challenges facing society are drawing environmental prediction into those margins, into new scales (the very large and very small) and new processes such as dynamic evolution. This is seeing the development of new analytical and modelling methods. A lot of effort in the coming decades will go into mastering these methods, weaving in the new scales and processes and revolutionising the way we communicate the results so that it truly supports informed decision making.

Session 2 – The need for prediction science

Professor Rob Vertessy

University of Melbourne

Rob is Enterprise Professor in Water Resources at the University of Melbourne. Previously, he served as Chief Executive of the Cooperative Research Centre for Catchment Hydrology (2002–2004), Chief of CSIRO's Land and Water Division (2004–2007) and the CEO of the Bureau of Meteorology (2011–16). He chairs the Australian Academy of Technology and Engineering (ATSE) Water Forum and the MDBA Advisory Committee on Social, Economic and Environmental Science. Rob also chairs the Expert Panel that is scoping up a National Environmental Prediction System (NEPS) under the Department of Education and Training's Research Infrastructure Investment Plan (RIIP). Rob recently led the Australian Government's Independent Assessment into the Fish Deaths in the lower Darling River.



Abstract

The Australian Government Department of Education and Training has commissioned the *NEPS Scoping Study* to provide technical assessments and requirements analysis for a NEPS, and to define implementation costs and timeframes to establish and manage a NEPS as national research infrastructure to meet researcher and operational user needs. The *NEPS Scoping Study* involves undertaking targeted consultations with key experts and stakeholders, including relevant areas of the existing National Collaborative Research Infrastructure Strategy (NCRIS) network. The Australian Government has established an Expert Panel to conduct the *NEPS Scoping Study*. The Chair of the Panel is Professor Rob Vertessy and the members are Professor Bronwyn Harch, Dr Andrea Hinwood, Dr Adam Lewis, Dr Phil McFadden AO, Mr Warwick McDonald and Dr Steve Morton. The Terrestrial Ecosystem Research Network (TERN), an NCRIS-funded initiative headquartered at the University of Queensland, provides support to the Expert Panel. The *NEPS Scoping Study* seeks to obtain broad agreement from key stakeholders regarding the focus of a NEPS, and develop a detailed establishment plan, including identification of stakeholder co-investments and actions necessary to support the development and maintenance of a NEPS. In his presentation, Rob will provide an update on progress with the *NEPS Scoping Study*, highlighting what the expert panel are seeking from the science community in helping to define the proposed NEPS scope.

Dr Jillian Edwards

National Resilience Taskforce

In April 2018 Jillian joined the National Resilience Taskforce a special purpose unit within the Department of Home Affairs. Jill brings with her over 30 years of experience in the emergency management sector as a thought leader in shaping and strengthening Australia and our pacific neighbours capability and capacity to address disaster and natural hazard risks. Most recently, Jill led the Australian Vulnerability Profile project to better understand what makes Australia vulnerable to disaster. A first for Australia, and a deeply collaborative project, this work informed the development of the recently endorsed National Disaster Risk Reduction Framework. It begins to address the least understood component of disaster risk – *systemic vulnerability*.

Abstract

Beyond Business as Usual

It is more and more evident the world can no longer rely on the stability of social, economic and natural systems affected by the growing resource demands of more than 7 billion people and a changing climate. This situation gives rise to a growing and urgent need to make transformative decisions in the face of deepening uncertainty and increasingly inexact (even entirely absent) information and within multi-sector governance structures.

Despite Australia's world-leading plans and capabilities, disaster trends challenge us and can overwhelm our collective ability to cope. As the nation's disaster risk grows, the capacity of households, communities, industry and governments to be resilient to disasters diminishes.

Disasters shine a light on existing and systemic problems. They illuminate the stresses, dependencies and challenges that were already there and create new ones. To reduce systemic disaster risk, we need to understand the points at which risk is created, managed and transferred. To do this we need better decision-ready data, information and guidance, scaled and contextualised for a future that is increasingly uncertain.

The challenges demand we go *beyond business as usual* and co-design new approaches to better prepare, and coordinate existing efforts and investments. We need to do more than change at the margins.

Dr Beth Brunoro

Department of Energy and Environment

Beth has led the Knowledge and Technology Division since it was established in mid-2017, which houses a critical mass of the Department's science, data, technical and technology expertise. Prior to this, Beth spent around ten years undertaking a range of domestic and international climate change roles for the Australian Government, including oversight of Australia's emissions projections, international negotiations and analysis (including as a senior member of Australia's delegation to the Paris climate conference), adaptation and climate science policy, as well as leading a range of energy policy and program activities. Previous to this, she spent five years in the Human Service portfolio. Beth has a Bachelor of Business and a Masters degree in Environmental Management.



Session 3 – Future and problem framing

Dr Mark Stafford Smith

CSIRO

Dr Mark Stafford Smith is based in Canberra, Australia, and is now an Honorary Fellow with CSIRO, where he continues to contribute to climate adaptation research. He interacts regularly with national and international policy issues around adaptation and sustainable development. Through 2013-17, he was Chair of the inaugural Science Committee for *Future Earth*, which aims to help coordinate research towards global sustainability worldwide; he remains active internationally. By background, he lived in Alice Springs for 20 years where, as a desert systems ecologist and past CEO of the Desert Knowledge Cooperative Research Centre (CRC), he focused on the science of desert living and sustainable management of outback environments.



Abstract

Framing complex social-ecological futures

How can environmental prediction and modelling interface with societal processes of visioning futures? Scenario processes are often described as differentially exploring what is *likely to be*, what *could be*, or what *should be*. Whilst being able to draw on some similar supporting information, these have profoundly different purposes, requiring different methods and forms of engagement. In particular, the role of stakeholders in relation to technical support differs critically.

Opening up scenarios to more stakeholder input also highlights diverse values, that cannot all be captured in conventional environmental modelling. In recent years the simple use of 'triple bottom line' to approximate this diversity has given way to a more sophisticated but complex framing such as that of the Sustainable Development Goals. This provides new opportunities with a mix of quantitative and qualitative approaches to think about how to manage conflicts in objectives, and at least then maximise synergies and identify key trade-offs in ways that can seek to take the heat out of polarised debates.

Professor Gabriele Bammer

The Australian National University

Gabriele Bammer is developing the new discipline of Integration and Implementation Sciences (i2S) to improve research strengths for tackling complex real-world problems. She looks at applications in population health, in environment and in security. She is a professor in the Research School of Population Health at The Australian National University. She curates the popular Integration and Implementation Insights blog (<http://i2Insights.org>). Her books include *Disciplining Interdisciplinarity: Integration and Implementation Sciences for Researching Complex Real-World Problems* (author, 2013), *Change! Combining analytic approaches*



with street wisdom (editor, 2015), *Research Integration Using Dialogue Methods* (co-author, 2009), and *Uncertainty and Risk: Multidisciplinary Perspectives* (co-editor, 2008).

Abstract

Disciplining Interdisciplinarity and Embracing Unknowns

Effectively understanding and responding to complex societal and environmental problems requires more expansive ways of approaching problems and significant new expertise, not just tweaks to business as usual. Interdisciplinarity requires specific expertise to address problems with:

- no clearly defined limits
- contested definitions
- unresolvable unknowns
- real-world constraints on understanding and action
- solutions that can only ever be partial and temporary.

This expertise needs to be codified so that it can be effectively shared, taught and built on. One way to achieve this is through a new discipline of Integration and Implementation Sciences (i2S), structured around three domains: synthesis of knowledge from disciplines and stakeholders, understanding and managing diverse unknowns and supporting policy and practice change.

Of these, understanding and managing diverse unknowns is least developed. Various taxonomies are starting to highlight different kinds of unknowns, for example known unknowns, unknown knowns and unknown unknowns, as well as differentiating what we are ignorant of from what we choose to ignore, or distinguishing error from vagueness. There's also growing interest in how to deal with unknowns that cannot be either reduced or ignored but must be accepted. The key issue is avoiding adverse unintended consequences and nasty surprises, especially those with major impacts.

Dr Michael Dunlop

CSIRO

Mike Dunlop works on the intersection between the social, institutional and biophysical dimensions of climate adaptation. Mike has a background in physics and ecology, and has evolved into an 'integration scientist', with *people* now his chosen study organism. His work focuses on helping policymakers and managers explore institutional changes to enable organisations and society prepare for significant but uncertain change. His practice involves developing learning based engagement processes that combine new ideas about adaptation and the contexts of partners charged with planning and implementing adaptation in various settings. He has worked across nature conservation, agriculture, ecosystem depended livelihoods, urban coastal settings and natural hazards. He works with National, State and local governments, NRM organisations and NGOs in Australia and internationally.



Abstract

Environmental prediction through the lens of transformational adaptation

There is a very real prospect that future environmental change will drive transformations in society. future environmental change will be widespread, affecting every corner of the planet, all ecosystems and all sectors, and it has the potential to lead to impacts on society that are significant and necessitate responses that are markedly different from current practices. This talk will describe an approach we have developed to help enable adaptation to transformational environmental change. This can be used as one framing for considering the needs for environmental prediction.

Key points about the approach include:

It addresses adaptation as a governance problem, looking at the needs of decision makers at a societal level, as an alternative to analysis driven by an understanding of impacts.

It identifies different types of future information need, for example those associated with anticipating:

- what successfully living with change might look like (the scope of a transformed system)
- the challenges for decision makers and society in getting there (transition to a new system)
- information that will help overcome barriers to transition (learning to do differently).

It highlights the complex nature of the interactions between knowledge and values and rules, and the benefit of viewing this as a co-evolutionary process rather than a knowledge transfer process.

It reveals the multiple different people, organisations, sectors and so on that require knowledge about the future in order for society to be able to transition.

Dr Andre Zerger

CSIRO

Dr Andre Zerger is the Director of the Atlas of Living Australia (ALA) having commenced with CSIRO in February 2019. Andre is an environmental science and data infrastructure professional with a background in spatial sciences and environmental modelling with a focus on ecological sciences. Prior to commencing with the ALA Andre was with the Bureau of Meteorology leading the design and delivery of the National Environmental Information Infrastructure (NEII) Programme and the operation of data systems supporting Australia's water information capability.



Abstract

Connecting data infrastructure with prediction systems – opportunities and challenges

Environmental data infrastructures have reached a point of maturity in Australia where they can now operationally support a suite of environmental monitoring, reporting and prediction needs at a relatively low cost of entry for users (output-side). However, barriers still exist to harnessing the full richness of data that exists in Australia that will be necessary to deliver integrated prediction systems (input-side). The presentation explores the role of soft enablers, including for example the role social architectures in delivering more comprehensive national data to support future generation environmental prediction systems. The presentation draws on experiences from the NEII, ALA and the Australian Water Resources Information System.

Sarah Richmond

Griffith University

Sarah Richmond is a Program Manager in eResearch Services at Griffith University. Sarah currently coordinates the development and delivery of the Ecoscience DEVL/RDC Project (*ecocloud*), as well as the Biodiversity and Climate Change Virtual Laboratory (BCCVL). With a research background in ecology, she has a special interest in enhancing environmental research through digital solutions by building integrated, user-friendly and supported cloud platforms for accessing data and analysis workflows. Sarah has both a professional and personal passion for tackling complex technical challenges to better allow researchers and decision-makers to efficiently guide practical solutions to significant environmental problems.

Abstract

ecocloud: connecting an ecosystem of infrastructure for environmental research and decision-making

Access to good quality ecological and biodiversity data alongside analysis tools is critical to synthesising our understanding of the natural world and making forward projections into novel conditions. Recent technologies have enabled consistent and continuous collection of ecological data at high resolutions across large spatial scales, and there are a number of initiatives and institutions collecting this data. The challenge remains, however, to bring these data together and expose them to methods and tools to analyse the interaction between biodiversity and the environment. These challenges are mostly associated with the accessibility, visibility and interoperability of data hosted in disparate places, and the technical capacity, computation and analysis needs of those interpreting the data. This is where *ecocloud* comes in.

ecocloud is an online environment that works the way ecologists do. It consists of two virtual laboratories, *ecocloud Platform* and the Biodiversity and Climate Change Virtual Laboratory (BCCVL), that provide specialist data visualisation and analytical tools and workflows for transparent and repeatable analytics. It also includes an innovative training and skills development program to help drive a skilled workforce of students, researchers, government practitioners and industry professionals working across the domain. This talk will give an introduction to the *ecocloud Program* and the underlying microservice architecture model, and highlight some of the challenges around sustainability of these platforms.

Matt Paget

CSIRO

Matt Paget is a data and systems specialist for Earth observation (EO) sciences in CSIRO Land and Water. He supports the processing pipelines of EO data and the development of server-side analytics and access for these data. He co-leads CSIRO's contribution to the international Open Data Cube community (www.opendatacube.org) with specialities in architecture, applications coordination and governance. He helped design, develop and support the Terrestrial Ecosystem Research Network (TERN) EO capability (TERN Landscapes) since TERN's inception as an NCRIS Facility in 2010, with a strong focus on cooperation and coordination between Australian research agencies.

Dr Adrian Burton

Australian Research Data Commons

Dr Adrian Burton is a member of the executive team of the Australian Research Data Commons (ARDC), as the director of Data, Policy and Services. He has previously held the role of Director at the Australian National Data Service (ANDS). He has a PhD in South Asian Languages, Literatures, and Linguistics from the Australian National University.

Session 5 – Modelling for prediction science

Dr Steven Lade

Stockholm Resilience Centre

Dr Steven Lade is a researcher at the Stockholm Resilience Centre at Stockholm University, Sweden. Funded by a young researcher mobility grant from the Swedish Research Council Formas, he is currently on an extended visit to the Fenner School of Environment and Society at the Australian National University. He uses complex systems methods to study problems in resilience and sustainability ranging across fisheries, agricultural poverty traps, and Earth system science.

Abstract

Regime shifts and resilience in social-ecological systems

My research deals with two phenomena that make environmental prediction difficult. (1) Ecosystems are subject to regime shifts: nonlinear shifts in ecosystem state that are large, sudden and difficult to reverse. (2) Understanding human behaviour is crucial for managing ecosystems. People behave in complicated ways, that can be difficult to predict, and can display nonlinear dynamical patterns such as traps. While these uncertainties can render prediction difficult or impossible, all is not lost. Modelling can still be used to explore and understand the mechanisms that govern human-environment dynamics and anticipate what kinds of future dynamics are possible. I illustrate this mode of modelling using two pieces of research: (i) a social-ecological modelling study of the Baltic Sea cod collapse and (ii) a conceptual modelling study of poverty traps in developing-world agricultural communities.



Dr Carmel Pollino

CSIRO

Carmel Pollino has 18 years of experience working in Environmental Flows, Hydrology, Ecology, Risk Management and Integrated River Basin Planning, considering water quality and quantity issues. This work has been done within complex governance, stakeholder and cultural contexts. Carmel has worked with Agencies in supporting water resource and natural resource planning, within Australia and Internationally.

Dr Andrew Rendall

CSIRO

Andrew leads the Integration Science and Modelling (ISAM) capability at CSIRO. He has more than a decade of specialised experience in applied quantitative economic and financial modelling, primarily focused on macroeconomic policy, extractive industries, power, intellectual property, competition economics and human capital. Andrew has extensive experience in fiscal policy reform, project valuation and negotiations, with government and private sector clients spanning 30+ countries. Andrew earned a B.Sc. (economics) from The Pennsylvania State University, an M.A. (economics) from Tufts University and a Ph.D. (economics) from the University of Zurich.



Abstract

ISAM: At the frontier of integrated modelling capabilities

CSIRO's Integration Science and Modelling (ISAM) is on the frontier of integrated modelling capabilities worldwide and can quantitatively address a wide variety of topics across multiple dimensions. This capability builds upon the deep domain expertise across CSIRO using applied scenario science, sophisticated computational frameworks and macroeconomic models. ISAM underpins the on-going Australian National Outlook (ANO) series that highlights the strengths of scenario-based modelling. Starting with the ground-breaking achievements of the first ANO (2015), ISAM continues to be a global benchmark for high-impact and scientifically rigorous integration capabilities.

Session 6 – From prediction science to application

Louise Freebairn

ACT Health

Louise Freebairn is Assistant Director, Epidemiology Section, ACT Health. Her research interests include building capacity to mobilise knowledge and better use evidence to guide health policy decision making. She is currently seconded to a collaborative project with The Australian Prevention Partnership Centre to develop the use of technologies such as dynamic simulation modelling and app-based data collection to explore complex public health issues using co-production and participatory methods. Louise has worked with health services in the ACT and NSW since 1997 in roles including clinical psychology, health services planning and epidemiology.



Abstract

Co-producing knowledge using participatory modelling for complex, policy questions

Systems science methods such as dynamic simulation modelling are increasingly being used to address public health policy questions, as they consider the complexity, context and dynamic nature of system-wide behaviours. Co-production of knowledge and involving policy decision makers in the model development

process is an important, but often not explicitly considered, component of project design and implementation. Key implementation strategies for operationalising interdisciplinary, participatory modelling approaches will be discussed. The reported experiences of end-user decision makers, including senior public health policy makers and health service providers, who took part in participatory simulation modelling projects for applied health policy decision support (alcohol related harm, childhood obesity prevention, diabetes in pregnancy), and their perceptions of the value and efficacy of this approach will also be described. The 'co-production' aspect of the participatory approach was highly valued and considered to be an essential component of building understanding of the modelling process, and thus trust in the model and its outputs as a decision-support tool. The participatory aspect of simulation modelling was time and resource intensive and therefore most suited to high-priority, complex topics with contested options for intervening.

Dr Russ Wise

CSIRO

Dr Russ Wise is a Senior Sustainability Economist in the Climate Risks and Resilience Group at CSIRO in Canberra, Australia. Russ has expertise in a diversity of disciplines including economics, ecology, geography, and social change processes. Over the last 12 years Russ has led interdisciplinary teams and research programs in South Africa and Australia focused on building stakeholders' capacities to understand and respond to unprecedented global changes in climate, ecosystems, and socio-economic development. In doing so, Dr Wise has become one of Australia's leading authorities in climate adaptation, particularly in relation to overcoming barriers to long-term planning and decision-making under uncertainty. Key to this has been the development of novel approaches to diagnosing climate adaptation and disaster mitigation problems and to collaboratively developing flexible adaptation pathways and informing adaptation policy and investment decision making. Russ has experience in climate adaptation, economic development and disaster mitigation in Australia, Papua New Guinea and Indonesia. Russ has more than 70 peer-reviewed publications, including >30 technical reports and >40 scientific journal papers. More details about Russ can be found at: <http://people.csiro.au/W/R/Russell-Wise>; <https://research.csiro.au/eap/>; <http://www.researcherid.com/rid/G-5463-2010>.



Abstract

Futures literacy and strategic decision-making under uncertainty

There are three broadly distinct types of decisions that consider future uncertainties associated with large, rapid and ongoing population, socio-economic, and environmental changes in quite different ways. Optimisation decisions in high-reliability environments tend to consider future uncertainties in cost-benefit analyses using probability distributions around a most-likely or largest-plausible change scenario. Contingency planning / decision making in less controllable systems need to use exploratory scenario approaches to identify low regrets (i.e., robust or flexible) responses that perform satisfactorily across many possible future scenarios. Finally, transformative decision making requires 'rigorous imagination' that draws upon inspiration, legacy, chance, and mystery to explore and prepare for the potentiality of the present to undergo radical novel shifts or discontinuities. All of these decision types, however, increasingly need to adopt iterative and adaptive approaches that consider cross scale influences (a scale above and below) and diverse knowledge types with the express purpose of learning more about the ongoing and increasingly unprecedented effects of global change. The talk introduces a knowledge mapping framework

to explain these issues and to point to context-sensitive decision approaches and criteria for considering uncertain futures.

Dr Steve Cork

The Australian National University

Steven Cork, BSc, PhD, is an ecologist and futurist. He played a lead role in developing the Millennium Ecosystem Assessment scenarios for the future of the world and has worked as a researcher (CSIRO), advisor to governments on policy issues, and as a government employee developing and implementing environmental policy. He is the Principal Consultant of *Ecolnsights*, a director of the private sustainability R&D organisation Australia21, and teaches *Environmental Policy and Communication* and *Science, Technology and Public Policy* as an Adjunct Professor in the Crawford School of Public Policy at the Australian National University.



Abstract

Cultural challenges for thinking about the future

Humans deal with complexity and uncertainty largely by ignoring or denying them. We filter information to fit with our simplified mental models about how the world works and we fool ourselves that we can predict the future. Within societies and organisations, we tend to support leaders who reassure us they know what the future holds, yet there is overwhelming evidence that useful anticipation and preparation for future challenges and opportunities requires considering multiple plausible futures and continuously testing and modifying assumptions and expectations. This presentation will give examples of what might be required to develop more appropriate cultures and build bridges between cultures that think differently about the future.

Attendees

	Ms	Maryam	Ahmad	CSIRO
	Mr	Cameron	Allen	University of NSW
	Dr	Sam	Andrew	CSIRO
	Dr	Ken	Anthony	Australian Institute of Marine Science
	Professor	Kate	Auty	Commissioner for Sustainability and the Environment
	Professor	Gabriele	Bammer	The Australian National University
Emeritus Professor		Michael	Barber	Australian Academy of Science
	Dr	Simon	Barry	CSIRO Data61
	Ms	Helen	Beringen	CSIRO
	Dr	Erin	Bohensky	CSIRO
	Mr	Paul	Box	CSIRO
	Dr	Elisabeth	Bui	CSIRO
	Dr	Adrian	Burton	Australian Research Data Commons
	Dr	Iadine	Chades	CSIRO
	Dr	Francis	Chiew	CSIRO
	Ms	Jane	Coram	CSIRO
	Dr	Steven	Cork	The Australian National University
	Dr	Simon	Cox	CSIRO
	Dr	Neville	Crossman	Murray-Darling Basin Authority
	Mr	Mark	Crosweller	National Resilience Taskforce, Department of Home Affairs
	Ms	Fiona	Dickson	Department of the Environment and Energy
	Dr	Veronica	Doerr	CSIRO
	Dr	Mike	Dunlop	CSIRO
	Ms	Cheryl	Durrant	Department of Defence
	Ms	Jillian	Edwards	National Resilience Taskforce, Department of Home Affairs
	Dr	Cameron	Fletcher	CSIRO
	Ms	Dianne	Flett	CSIRO contractor
	Ms	Louise	Freebairn	ACT Health
	Dr	Beth	Fulton	CSIRO
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