ECOSYSTEM SURPRISES + RAPID COLLAPSE

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ABSTRACT BOOK

2018 Boden Research Conference

Table of Contents

Predicting ecosystem responses to species eradications and reintroductions: smooth sailing or catastrophic collapse?

Adams M[1], Baker C[1], Plein M[1], Holden M[1], Sisson S[2], Helmstedt K[3], McDonald-Madden E[1]
[1]The University of Queensland, [2]University of New South Wales, [3]Queensland University of Technology

Rapid coral decline and the challenge of severe marine heatwaves

Ainsworth T[1]
[1]The University of New South Wales

Modelling species interactions for decision-support

Baker C[1]
[1]The University of Queensland

Physiology of plants behind ecosystem collapse and surpises

Ball M[1]
[1]Research School of Biology

From ashes to ashes, dust to dust – will frequent burning of Pindan vegetation create Australia's next great desert?

Barrett R[1]
[1]Royal Botanic Gardens & Domain Trust, Sydney, [2]Australian National Herbarium, CSIRO, [3]Australian National University

Collapse of an alpine ecosystem on subantarctic Macquarie Island

Bergstrom D[1]
[1]Australian Antarctic Division

The world ablaze will have nasty pyrogeographic surprises

Bowman D[1]
[1]University of Tasmania

Guidelines for establishing experimental plantings in restoration projects.

Broadhurst L[1]
[1]CSIRO

Physiological mechanisms of drought-induced mortality in woody plants

Choat B[1], Peters J[1], Blackman C[1], Li X[1], Tissue D[1], Medlyn B[1]
[1]*Western Sydney University*

Physiological traits and multiple stable states in ecology

Chown S[1]
[1]*School of Biological Sciences, Monash University*

What role can nature connection play in conservation management during uncertain times?

Cleary A[1], Roiko A[1], Fielding K[2], Murray Z[1]
[1]*School of Medicine Griffith University,* [2]*School of Communication and Arts, The University of Queensland*

The uncertain future of early warning signals

Clements C[1]
[1]*University of Melbourne*

Predicting plant performance in a changing world: how seeds respond to temperature

Cochrane A[1]
[1]*Dept Biodiversity, Conservation and Attractions*

Ecological complexity presents challenges and solutions

Connell S

Ecological Surprises and Rapid Collapse of Ecosystems: A Global Perspective

Depledge M[1]
[1]*European Centre for Environment& Human Health*

Potential regime shift in the subantarctic fellfield: Island-wide decline of a keystone species.

Dickson C[1], Bergstrom D[2], Whinam J[3], McGeoch M[1]
[1]*Monash University,* [2]*Australian Antarctic Division,* [3]*University of Tasmania*

Managing for lower fuel hazard and higher biodiversity: the importance of long-unburnt forests and woodlands.

Dixon K[1]
[1]*Australian National University*

Mass dieoff of mangroves in Australia's remote north – 2 years on!

Duke N[1]

[1]James Cook University TropWATER Centre

A New Fire Paradigm for Tall Wet Eucalypt Forests: Examining the macro-ecological variation in fire regime in Australia's most unique forest type

Furlaud J[1], Bowman D[1]
[1]University of Tasmania

A tale of two scales: molecular and biogeographic responses of Australian plant to heat waves and climate change

Gallagher R[1], Wright I[1], Maher T[1], Pascovici D[1], Mirzaei M[1]
[1]Macquarie University

Increases in extreme rainfall events pose significant risk to Australian dryland ecosystems

Greenville A[1], Wardle G[1], Dickman C[1]
[1]University of Sydney

Moor than meets the eye: secondary impacts are a dominant driver of decline in a threatened seagrass meadow.

Griffin K[1], Clark G[1], Poore A[1], Vergés A[1], Johnston E[1]
[1]UNSW

Fire Cycle: connections between ecological and human crisis and recovery

Hames F[1]
[1]Arthur Rylah Institute for Environmental Research

Stress in the city: learning about plant stress in the concrete jungle

Haynes A[1]
[1]University of Wollongong

Value of dynamic multi-species modelling for avoiding ecosystem collapse

Holden M[1]
[1]University of Queensland

Vegetation Responses to Extreme Wetting and Drought Events in Central Australia: A View from Space

Huete A[1], Cleverly J[1], Leng S[1], Xie Q[1], Jones L[2]
[1]University of Technology Sydney, [2]University of Montana

Renewal Ecology: Conservation for the Anthropocene

Hughes L[1]
[1]Macquarie University

Loss of kelp-bed habitat in Australia: Dissimilar mechanisms in different regions all relate to climate change

Johnson C[1]
[1]Institute for Marine & Antarctic Studies

Ecosystem collapse: from science to policy

Keith D[1]
[1]Unversity of NSW

Changes in health of Windmill Islands vegetation: a decade of monitoring

King D[1], Wasley J[2], Ryan-Colton E[1], Benny T[1], Lucieer A[3], Chisholm L[1], Robinson S[1]
[1]University of Wollongong, [2]Australian Antarctic Division, [3]University of Tasmania

Using ecology to inform urban marine designs in a changing climate

Mayer-Pinto M[1], Dafforn K[2], Johsnton E[1]
[1]EERC, BEES, The University of New South Wales, [2]Macquarie University

Making ecosystem management decisions when we know almost nothing

McDonald Madden E

Detecting and interpreting critical transitions in biodiversity

McGeoch M[1]
[1]Monash University

Predicting and responding to future change in biodiversity composition and ecosystem function

Mokany K[1], Harwood T[1], Ferrier S[1]
[1]CSIRO

Future proofing conservation: capacity building for protected areas management under climate uncertainty

Munera C[1], Van Kerkhoff L[1], Dunlop M
[1]Australian National University, [2]CSIRO

How do species interactions and ecological complexity modify the effects of ocean acidification and warming on marine species and ecosystems?

Nagelkerken I[1]

[1]The University of Adelaide

Developing a standardized definition of ecosystem collapse for risk assessment

Nicholson E[1], Bland L[1], Rowland J[1], Keith D[2]
[1]Deakin University, [2]UNSW

Ecosystem surprises and collapse: designing pathways to diminish disaster

O'Connell D[1], Maru Y[1], Grigg N[1]
[1]CSIRO

Recent ecological change in Australia: are people perceiving climate-related changes in their local biodiversity and ecosystems?

Raisbeck-Brown N[1], Prober S[1], Porter N[1], Leviston Z[2], Norman E[3], Dickson F[3], Williams K[4]
[1]CSIRO Land and Water, [2]Edith Cowan University, [3]Department of Environment and Energy, [4]CSIRO Land and Water

The Australian Ecosystem Models Framework

Richards A[1], Dickson F[2], Prober S[1], Roxburgh S[1], Cook G[1], Metcalfe D[1], Murphy H[1], Warnick A[1], Williams K[1], Doherty M[3]
[1]CSIRO Land and Water, [2]Department of the Environment and Energy, [3]Australian National University

Biodiversity transformations in Antarctic terrestrial ecosystems

Robinson S[1], Waterman M[1], King D[1], Turnbull J[1], Ashcroft M[1], Bramley-Alves J[1], Ryan-Colton E[1], Wasley J[2], Hua Q[3]
[1]University of Wollongong, [2]Antarctic Conservation and Management Program, Australian Antarctic Division, [3]Australian Nuclear Science and Technology Organisation (ANSTO)

Evolutionary enlightened conservation: improving biodiversity outcomes under climate change

Sgro C[1], Cook C[1]
[1]Monash University

Climate change effects in ecosystems with non-linear environmental gradients.

Stark J[1], Raymond B[1], Clark G[2]
[1]Australian Antarctic Division, [2]Applied Marine and Estuarine Ecology Evolution & Ecology Research Centre University of New South Wales

Developing a framework for assessing regime shift dynamics in ecosystems

Ward D[1,2], Melbourne-Thomas J[2,3], Johnson C[1], Hindell M[1,2], Wotherspoon S[1,3], Constable A[2,3]
[1]Institute of Marine & Antarctic Studies, University of Tasmania, [2]Antarctic Climate & Ecosystems CRC, University of Tasmania , [3]Australian Antarctic Division, Department of Environment and Energy

Ecosystem collapse of Georgina gidgee woodlands is predicted based on an IUCN Red List of ecosystems assessment

Wardle G[1], Dickman C[1], Greenville A[1]
[1]*The University of Sydney*

National mapping of biodiversity habitat condition for comparative assessments across regions (i.e. capacity of an area of vegetation to provide the structures and functions necessary for the persistence of plant and animal species that would be expected to occur at that location if it were still in a natural state)

Williams K[1], Dickson F[2], Donohue R[1], Ferrier S[1], Harwood T[1], Lehmann E[3], Lyon P[2], Macfarlane C[4], McVicar T[1], Ozolins M[2], Pinner L[2], Storey R[2], White M[5]
[1]*CSIRO Land and Water,* [2]*Department of the Environment and Energy,* [3]*CSIRO Data61,* [4]*CSIRO Land and Water,* [5]*Department of Environment, Land, Water and Planning*

Positive feedbacks to fire in eucalypt forests: drivers and implications

Zylstra P[1]
[1]*University of Wollongong*

Predicting ecosystem responses to species eradications and reintroductions: smooth sailing or catastrophic collapse?

Adams M[1], Baker C[1], Plein M[1], Holden M[1], Sisson S[2], Helmstedt K[3], McDonald-Madden E[1]
[1]The University of Queensland, [2]University of New South Wales, [3]Queensland University of Technology

Biography:
Matthew is a postdoctoral fellow who uses applied mathematical modelling to investigate the dynamics underlying ecological, biological and physical systems. Matthew's work spans the spectrum from quantitative analysis of experimental data to theoretical models, and focuses especially on environmental systems. He is currently working on improving decision-making for species translocations.

Species eradications and reintroductions are drastic management actions that alter ecosystem structure with the end goal of conserving or restoring one or more species of interest. However, because of the complexity of ecosystem food webs, these actions can have unintended consequences on other parts of the ecosystem. In this talk, I show how dynamic models of the ecosystem food web, calibrated by species abundance data, can be used to predict future responses of the ecosystem to species eradications and/or reintroductions. I discuss the advantages and limitations of these data-calibrated models, and specifically whether they can be used to predict if the future is smooth sailing, or if catastrophic collapse of one or more species in the ecosystem is likely.

Rapid coral decline and the challenge of severe marine heatwaves

Ainsworth T[1]
[1]The University of New South Wales

Biography:
I am a Scientia Fellow at The University of New South Wales where I study the impact of climate change to corals and coral reefs and the role of host-microbe-environment interactions and symbiosis in organism function. My research aims to determine how host-microbe-environment interactions influence organism physiology, adaptation and acclimation.

Globally coral reefs are increasing threatened by a rapidly changing climate. Here I will outline research into severe marine heatwave conditions and discuss how these events result in rapid bleaching-induced coral mortality which is accompanied by severe skeletal dissolution. Evidence shows that these heat wave driven decay and dissolution events result in reduced skeletal density, increased porosity, and a loss of hardness in corals, which are likely to result in coral reefs being susceptible to collapse immediately following severe events. In fact corals subjected to severe marine heat waves in 2016 were observed to undergo a framework decay within a 6-week period. Our research suggests that the rapid transition to coral mortality, microbial biofilm formation, and skeletal decay during marine heatwaves, is likely to become more common on coral reefs as severe events become more frequent.

Modelling species interactions for decision-support

Baker C[1]
[1]The University of Queensland

Biography:
Chris is a research fellow at the University of Queensland. His work focuses on modelling species dynamics under management to provide advice on how to improve management.

Incorporating species interactions into management plans is a key challenge for conservation science. Degrading ecosystems require urgent management to conserve biodiversity, and invasive species cause incredible damage to ecosystems, particularly on islands, which contain a huge proportion of biodiversity. Species interactions are complex and it's hard to predict future dynamics and ecosystem wide impact of management. Hence, we need to implement modelling methodologies that explicitly incorporate species interactions when designing management strategies. I will discuss our recent work on modelling complex systems and how modelling can be used to support environmental decision-making.

Physiology of plants behind ecosystem collapse and surpises

Ball M[1]
[1]Research School of Biology

Biography:
Marilyn studies how physiological adaptations and responses to environmental stresses affect the structure and functioning of plant communities along environmental gradients. Her work spans mangroves, temperate evergreen sclerophylls, alpine, subantarcic and Antarctic vegetation.

Physiological vulnerabilities are often key components to ecosystem collapse. In this talk I will explore examples that illustrate this element across a range of ecosystems including mangroves, alpine and subantarctic systems.

From ashes to ashes, dust to dust – will frequent burning of Pindan vegetation create Australia's next great desert?

Barrett R[1]
[1]Royal Botanic Gardens & Domain Trust, Sydney, [2]Australian National Herbarium, CSIRO, [3]Australian National University

Biography:
Russell Barrett is a research botanist who grew up in the remote Kimberley region of Western Australia, discovering hundreds of new species. With over 30 years of field observations, he has become alarmed by rapid decline of the Pindan, covering the 8.3M ha Dampierland IBRA region

Pindan vegetation remains a poorly understood, but extensive community (8.3 M ha) at the western edge of the Australian tropical savanna. Typically applied to the dominant vegetation type in the Dampierland IBRA region in northern Western Australia, smaller analogous elements can also be found in parts of the Pilbara, in the Northern Territory, and western Queensland. Observations over the last thirty years have shown significant structural change to Pindan vegetation over the majority of its extent. The ecosystem is here considered to be on the verge of collapse unless dramatic changes are made to current landscape management practices. Current floristics combine tropical and desert elements, including many regional endemics. Pindan vegetation communities grow on previously wind-blown red sands deposited during an ancient arid phase. Formerly closed-canopy Pindan communities (sometimes a dry vine-thicket) are at risk of returning to a sparsely vegetated desert state with a risk of mobile dune development.

Collapse of an alpine ecosystem on subantarctic Macquarie Island

Bergstrom D[1]
[1]*Australian Antarctic Division*

Biography:
Dana is an applied Antarctic ecologist with a focused on understanding and protecting Antarctica at the highest level, while communicating the global importance of the region and its' science to the world.

In 2008, sudden widespread death in the keystone, alpine cushion plant species, Azorella macquariensis, was observed on subantarctic Macquarie Island. Over the next three years, additional death was noted resulting in the endemic species being declared critically endangered. This rapid collapse was most likely caused by a complex series of elements, including climate change and the possible emergence of a putative pathogen.
Dieback and post-dieback states are now prominent features of the ecology of the island. This is of significant concern for both the conservation of the endemic cushion plant, and also the structure and function of the fellfield and herbfield communities that Azorella dominates. I will discuss the current situation on Macquarie Island, where there is both recovery and continued widespread death, in the framework of our current understanding and consider the future for the species and its associated ecosystem.

The world ablaze will have nasty pyrogeographic surprises

Bowman D[1]
[1]University of Tasmania

Biography:
David's research is focused on the ecology, evolution, biogeography and management of Australian forested landscapes, especially the relationship between fire, landscapes and humans. His research spans fire ecology, the impacts, consequences and benefits of human burning, carbon dynamics and global warming

Since the beginning of this century extraordinarily intense, and economically and ecologically destructive, fires have occurred in flammable environments around the world (Australia, New Zealand, Chile, USA, Canada, Portugal, Spain). Through the application of pyrogeographic synthesis, that ties together historical, social and ecological factors, it is possible to illuminate the role of anthropogenic factors, including climate change, in driving this global syndrome. Yet precise prediction of major fires is impossible because of the complexity of factors, meaning that societies, and their politicians, planners and land managers, must become increasingly vigilante and prepared for surprising catastrophic fire events. I illustrate this argument with reference to the 2016 Tasmanian Wilderness Fires and the 2017 Chilean fires.

Guidelines for establishing experimental plantings in restoration projects.

Broadhurst L[1]
[1]CSIRO

Biography:
Linda has been at CSIRO since 2000 with her research initially focussing on the long term conservation and restoration of Australia's unique floral biodiversity. Her most recent research is assisting NRMs and NGOs establish good seed sourcing and production practices to help restored populations respond to changing environments.

Past investment in Australian restoration has developed a distributed network of highly knowledgeable and experienced practitioners. Predicted growth in the restoration sector to meet national and international restoration targets provides an opportunity to value-add to this investment. Upskilling practitioners to undertake experimental plantings within some of these projects can address a broad range of national questions such as the role of seed choice, the adaptability of plants to different environmental stressors, or the optimal species combinations and spatial arrangements of plantings. We are leading the development of 'National Guidelines for Experimental Restoration Plantings' (aka Guidelines) to assist practitioners to incorporate experimental plantings into their projects such that the outcomes will also contribute to future biodiversity analysis and decision-making. We will report on our progress and will be seeking expressions of interest from practitioners and agencies wishing to take part in road testing the Guidelines.

Physiological mechanisms of drought-induced mortality in woody plants

Choat B[1], Peters J[1], Blackman C[1], Li X[1], Tissue D[1], Medlyn B[1]
[1]*Western Sydney University*

Biography:
Brendan Choat is an Associate Professor and Future Fellow at Western Sydney University. His research centers on the physiological ecology of plants with a primary focus on plant hydraulics, water relations and functional anatomy.

Severe droughts have caused widespread tree mortality across many forest biomes with profound impacts on ecosystem function and carbon balance. Climate change is expected to intensify regional scale droughts via the effects of higher temperatures and evaporative demand. There is evidence to suggest that amplification of drought stress by anomalously high temperatures is already occurring. These events have focused attention on the physiological underpinnings of drought-induced tree death. Catastrophic failure of the plant hydraulic system is now recognised as a principal mechanism causing tree mortality during drought. Plant hydraulic failure is caused by the formation of gas emboli in the xylem conduits of leaves, roots and stems. Recent work has advanced our understanding of this process and identified species-specific physiological thresholds for tree death. I will explore our current understanding of tree response to drought and the potential application of hydraulic failure thresholds to process-based models predicting mortality.

Physiological traits and multiple stable states in ecology

Chown S[1]
[1]School of Biological Sciences, Monash University

A large variety of forms of catastrophes exist in theory, but the simple cusp catastrophe model most familiar to ecologists is the focus here. Smooth phase shifts to S-shaped curves for multiple stable states are encapsulated by the cusp catastrophe. Although physiological traits might be considered parameters in most models, they can also be thought of as state variables. The former might be considered most relevant to population-level models and will be examined briefly here, especially the role of trait evolutionary potential. The latter is relevant to any hierarchical level. The behaviour of traits as state variables, especially for whole assemblages, has not been well explored.

What role can nature connection play in conservation management during uncertain times?

Cleary A[1], Roiko A[1], Fielding K[2], Murray Z[1]
[1]School of Medicine Griffith University, [2]School of Communication and Arts, The University of Queensland

Biography:
Anne researches the links between the environment and human health with a specific focus on urban nature and mental health. Anne has worked with the World Health Organisation co-authoring several reports on urban green space and human health and has experience with ecological and social monitoring.

There is growing recognition that environmental issues are in part driven by an urbanising global population who are increasingly disconnected from nature. As a result, research and policy arenas are starting to identify nature connection, that is, our subjective sense of our cognitive, affective and experiential relationship with nature, as a potential tool for garnering support for conservation action. Nature connection objectives are starting to appear in a range of environmental policies (e.g. UK's 25 Year Plan to Improve the Environment, Victoria Government's Biodiversity 2037). Similarly, numerous environmental initiatives have been recently established with the primary aim of promoting nature connection (e.g. IUCN's #NatureForAll). However, much remains unknown about nature connection, in particular, how an individual's nature connection is enhanced and maintained. Analysis of recent survey data from Queensland helps to shed light on what shapes an individual's nature connection and how this may inform conservation management during uncertain times.

The uncertain future of early warning signals

Clements C[1]
[1]*University of Melbourne*

Biography:
I work with a combination of small-scale experimentation, theoretical modelling, and the analysis of long-term real-world data sets, to test and develop theory with the overarching goal of making conservation decisions based on quantitative evidence.

Predicting the fate of populations and ecosystems is a key goal in ecology, leading to the development of a suite of early warning methods ranging from trends in the statistical moments of abundance time series to shifts in the distribution of fitness-related phenotypic traits. However, the utility of such methods in predicting the fate of real-world systems in general remains unknown, as research has focused on the development and not validation of such tools.

I will argue that key to the development and implementation of these methods is an understanding of where they fit in the field of predictive ecology generally, and that available data should steer the evolution of these methods. I will then identify some key unanswered questions that, if solved, could improve the applicability and utility of early warning signals, and help ensure they form part of the arsenal of conservation decision-making tools.

Predicting plant performance in a changing world: how seeds respond to temperature

Cochrane A[1]
[1]*Dept Biodiversity, Conservation and Attractions*

Biography:
I have worked in the field of seed conservation for the past 25 years with a particular interest in researching seed responses to changing climates

Germination is crucial for colonization and persistence of many plant species. It is a high-risk phase in a plant's life cycle, and directly regulated by temperature. Seeds germinate over a range of temperatures with an optimum temperature(s) that provides fastest and most complete germination, and thresholds above and below which no germination occurs. Temperature changes associated with global warming may cause a disconnect between temperatures a seed experiences and temperatures over which germination can occur. This paper explores how seeds might respond to temperature, identifying the potential for recruitment failure in the future. Such failure may lead to rapid collapse of some species; however, some surprising resilience to supra-optimal temperatures has also been identified. Seed-based approaches to identifying extinction risk contribute tangibly to efforts to predict plant responses to environmental change and can assist to prioritize species for management actions, direct limited resources towards further investigations and supplement bio-climatic modelling.

Ecological complexity presents challenges and solutions

Connell S

Biography:
Sean has worked on modern-day collapse of seagrasses and kelp forests and has reconstructed lost histories of marine ecosystems going back 200 years. His recent interests include the linguistic analysis of scientific writing - which tends to be cryptic, convoluted, ambiguous. He has spent the last 6 months working in conservation psychology on the duality of optimism and pessimism in motivating public, business and political action. Today, he will focus on the dynamic of ecosystem stability.

Ecological complexity challenges our ability to predicting tipping points, yet its seems key to managing stability before catastrophe. I will present data on how species interactions (producer-consumer) buffer the effects of abiotic change on ecosystem processes (production) so that when these compensatory processes fail, the pace of decline can only be precipitous. Problematically for prediction, I have found that multiple species can jointly compensate for abiotic change; adjusting in their behaviour and population dynamics in tandem to stabilize ecosystem processes. Whilst such adjustability maybe difficult to predict, it may be manageable. If so, then, instead of monitoring decline, with the usual post-hoc analysis of the conditions of collapse, managers might bolster the dynamics that underpin stability and avoid collapse in the first place.

Ecological Surprises and Rapid Collapse of Ecosystems: A Global Perspective

Depledge M[1]
[1]European Centre for Environment& Human Health

Biography:
Michael is interested in all aspects of biology, but especially the intimate relationship between the environment, human health and wellbeing. He was Chief Scientist for the UK Environment Agency, is an advisor to WHO and UNEP and founded the 2008 European Centre of Environmental and Human Health, at Exeter University.

The Earth's ecosystems have been in constant flux since they first arose. Species have emerged as others died out in response to environmental modifications arising from natural causes, such as earthquakes, volcanic eruptions, and altered climatic conditions. However, over the last two centuries there has been growing recognition that human activities have themselves profoundly disrupted natural processes and added new perturbations, resulting in unexpected, ecological consequences. Often these are manifest as the rapid loss of particular species and collapse of ecosystem structure and processes.
In this brief presentation, examples will be provided to illustrate how and when ecological changes are likely to occur in the future, what their consequences are likely to be for human populations, and how they can be predicted, monitored and, where possible, managed. The recovery of ecosystems following collapse will also be considered.

Potential regime shift in the subantarctic fellfield: Island-wide decline of a keystone species.

Dickson C[1], Bergstrom D[2], Whinam J[3], McGeoch M[1]
[1]Monash University, [2]Australian Antarctic Division, [3]University of Tasmania

Biography:
Cath is a current PhD candidate with the McGeoch Research Group. Cath's research interest is the response of species and ecological communities to threatening processes and subsequent determination of appropriate conservation management actions.

The endemic, keystone species Azorella macquariensis (Macquarie cushion) has undergone rapid widespread decline across the subantarctic Macquarie Island, resulting in its listing as critically endangered in 2010. Characteristic features of this event suggest that a potential regime shift is underway; an alternative being recovery back to Azorella-dominated communities in fellfield (alpine) ecosystem. Initial research suggests that Azorella dieback is likely driven by a decadal reduction in plant available water, as a result of a significantly changed regional climate, which may have facilitated a secondary putative pathogenic infection of weakened plants. Mapping, modelling and monitoring of Azorella condition is essential to understand and best manage Macquarie Island's World Heritage Conservation status. Our results to date show significant spatial variation, and some trends in Azorella cover and dieback. The extent and nature of ecosystem change within the fellfield is still to be determined, however, near-term climate conditions will be important.

Managing for lower fuel hazard and higher biodiversity: the importance of long-unburnt forests and woodlands.

Dixon K[1]
[1]Australian National University

Biography:
Kelly's PhD focuses on ecosystem monitoring and evaluation. In particular, how management actions align with conservation objectives, and how science integrates into management within protected areas worldwide. She is particularly interested in fire management and investigates the impact various fire histories have on fuel hazard and biodiversity in the ACT.

Fuel hazard is often assumed to increase with time-since-fire and much prescribed burning is undertaken on this premise; however, studies on long-unburnt forests are scarce. Ecological studies have shown that frequent fire may maintain forests in a highly flammable 'shrubby' state and compromise biodiversity.

We measured fuel hazard and surveyed reptiles in forests and woodlands in Namadgi National Park, ACT, at 81 sites spanning less than one year to >96 years-since-fire, to investigate how time-since-fire affects fuel hazard and biodiversity.

Overall fuel hazard was highest in forests 6-12 years-since-fire than those unburnt for >96 years due to senesce of the highly flammable understorey. Reptile richness, abundance and key habitat attributes were significantly higher in long-unburnt sites. Long-unburnt areas were disproportionately more important for wildfire suppression and reptile diversity than younger fire ages. These areas should be protected as assets, and a larger proportion of forest transitioned to a long-unburnt state.

Mass dieoff of mangroves in Australia's remote north – 2 years on!

Duke N[1]
[1]James Cook University TropWATER Centre

Biography:
Dr Norm Duke (MSc, PhD) mangrove ecologist - specialises in global mangrove floristics, biogeography, climate impacts, vegetation mapping, pollution, restoration and shoreline condition assessments, with research and technical publications numbering more than 230 articles. Norm currently leads the Mangrove Research Hub at TropWATER Centre, James Cook University.

It was a surprise to everyone when mangroves, believed to be resilient, were observed dying en masse in the Gulf of Carpentaria in early 2016. This incident was especially cogent as it was co-incident with severe coral bleaching on the GBR, and a severe el Nino event. The landscape-scale statistics surrounding the dieback of mangroves, where 7,400 ha of forest trees died in 2-3 months along a 1,000 km shoreline, demonstrated clearly that these ecosystems were indeed, highly vulnerable to sudden changes in climate and environmental conditions. It was further remarkable that this incident was not only slow to be reported, but also because of its remoteness on Australia's northern coast, there was little chance of the usual direct human suspects being involved. In this talk, I will share recent insights, observations and concerns for better informing enlightened, effective management actions – like an effective national shoreline environmental monitoring capability.

A New Fire Paradigm for Tall Wet Eucalypt Forests: Examining the macro-ecological variation in fire regime in Australia's most unique forest type

Furlaud J[1], Bowman D[1]
[1]*University of Tasmania*

Biography:
James Furlaud is a PhD student at the University of Tasmania. A decade of field-based research in forests and a Master's in forest biometrics have given him a unique perspective on forest ecology. He is currently studying fuel dynamics and fire danger wet eucalypt forests.

Tall wet eucalypt forests are a globally-unique ecosystem present across the wetter forested areas of the continent. Conventional wisdom states that their fire regime is characterised by long inter-fire intervals punctuated by huge stand-replacing fires. This paradigm is used to justify clear-felling as a forestry practice and explain why fire behaviour models predict exceptionally intense fires in these forests. We have undertaken the first continental-scale measurement of fuel loads in mature tall wet eucalypt forests. Based on simulated flame heights from our empirical fuel measurements, we found these forests' fire regime to be highly variable. Remarkably, crown fires appear to be the exception rather than the norm. Furthermore, using data from actual fires, we found that low-severity fires can burn in these forests under mild fire-weather conditions. These results suggest that stand-replacing fires might be surprisingly rare in mature wet eucalypt forests, suggesting the need to rethink their fire paradigm.

A tale of two scales: molecular and biogeographic responses of Australian plant to heat waves and climate change

Gallagher R[1], Wright I[1], Maher T[1], Pascovici D[1], Mirzaei M[1]
[1]*Macquarie University*

Biography:
I am a plant ecologist and biogeographer investigating the vulnerability of vegetation to global change. I am focused on quantifying the impact of climate change at different levels of biological organisation from molecules to biomes.

Plant strategies for adapting to changing climates range from molecular to macroecological. I present two brief cases studies of climate change responses in the Australian flora which operate at vastly different scales of biological organisation. First, I provide evidence from quantitative proteomics for a strong relationship between heat-wave exposure in the field and protein expression response under experimental heat-wave conditions in six populations of Eucalytpus grandis. Second, I present a new continental-scale analysis of the vulnerability of Australian vegetation to climate change based on realised temperature and rainfall niche limits of ~19,000 species. This analysis shows that, across the Australian landscape, the 'safety-margin' for climate warming in plant communities varies between 0.2 – 8.5ºC and that the smallest safety-margins for climate warming are found in equatorial regions. I discuss the inherent challenges of reconciling fine-scale experimental work on single (or few) species with continent-wide analyses of climate change vulnerability.

Increases in extreme rainfall events pose significant risk to Australian dryland ecosystems

Greenville A[1], Wardle G[1], Dickman C[1]
[1]*University of Sydney*

Biography:
My research aims to predict how ecosystems respond to climate change and the introduction of exotic species. My research draws on vertebrate, invertebrate and plant groups to study ecosystem function and change.

Climate change is predicted to place up to one in six species at risk of extinction in coming decades, and projecting how ecosystems will respond is now one of our greatest challenges. Climate is a major driver for dryland species, and the remote Australian central desert regions are not immune from climate change. Here we integrate results from remote camera trapping and long-term (22 years) regional-scale (8000 km^2) datasets on vegetation and small vertebrates to explore how both abiotic and biotic factors drive dryland species. We then use structural equation modelling to explore how projected changes in rainfall and wildfire are likely to influence dryland ecosystems across a 100-year timeframe. We find that counterintuitive sets of biotic and abiotic processes operate across the different population phases stimulated by extreme rainfall events, and that projected increases in such events may pose increased extinction risks for native species in arid Australia.

Moor than meets the eye: secondary impacts are a dominant driver of decline in a threatened seagrass meadow.

Griffin K[1], Clark G[1], Poore A[1], Vergés A[1], Johnston E[1]
[1]*UNSW*

Biography:
Kingsley's research with Emma Johnston, Graeme Clark, Katherine Dafforn and others at UNSW has used technology-driven spatial methods to explore human impacts in marine systems (reef, seagrass and soft-sediments).

Physical impacts can cause unexpected effects beyond the zone of initial disturbance, but these processes are often overlooked, especially in marine systems. We examined the broader influence of physical disturbance for a threatened seagrass. Boat moorings cause characteristic circular clearings in seabed vegetation, but potential secondary effects due to these clearings (eg. sediment transport, fragmentation) and moored boats (eg. shading) are undefined.

We partitioned areas subjected to physical impact (0-5m) from those potentially exposed to secondary impacts (5-25m away). At the 0-5m scale we tested the effectiveness of moorings designed to avoid clearing vegetation. Further away (5-25 m) we tested if seagrass is affected by density of surrounding moorings. We found that density has a cumulative negative effect, but mooring design can reduce disturbance and in turn negate the effect of density.

We used a non-destructive strategy that may be applicable to other vegetation subjected to complex, overlapping impact sources.

Fire Cycle: connections between ecological and human crisis and recovery

Hames F[1]

[1]*Arthur Rylah Institute for Environmental Research*

Biography:

Fern builds links between science, partners and community. These links mean that ARI's applied research can truly help guide on-ground actions for biodiversity, and underpin policy decisions. Fern has three decades of experience across freshwater fish and aquaculture research, policy development, stakeholder engagement, environmental education, citizen science and emergency response.

The 2009 ‘Black Saturday’ wildfires were a major, traumatic event for people and the natural environment. Affected species included the tiny, nationally threatened Barred Galaxias. Post-fire rains were expected to cause massive silt mobilisation; smothering fish and habitats. Fire recovery actions included collecting a sample of fish from affected streams, and moving them to secure aquaria, while their habitat recovered. Simultaneously, fire-affected residents experienced a similar process; moving elsewhere while their homes were rebuilt. People recognised the synergy in the fish’s story and their own; moving house while their home recovered. Applying principles of trauma recovery, we worked collaboratively with local communities to give people a sense of control and connect them back to nature. This enhanced their valuing of nature, and triggered ongoing advocacy. We witnessed a cycle of paired recovery, in which natural recovery supported human recovery, and the recovering human community continued to support natural values recovery.

Stress in the city: learning about plant stress in the concrete jungle

Haynes A[1]
[1]*University of Wollongong*

Biography:
Alison Haynes studied conservation biology, with Honours in conservation genetics. Her PhD examines microhabitat and multiple stress in the urban environment using moss. She is a second career scientist, with a previous background in publishing.

Urban areas consist of a dramatic alteration of substrate, with associated changes in microclimate, leading to, for many organisms, a highly stressful environment. They present highly accessible locations to investigate links between species' distribution, differences in multiple stress tolerance and microhabitat preferences.

Moss is a good model taxa in this system: it is a pioneer and coloniser, hence demonstrates natural processes; its size means it can be manipulated in experimental treatments; its species diversity means it grows in a wide variety of ecological niches from rainforests to deserts. Moss also forms biocrusts, 'living skins' on substrates, along with cyanobacteria, fungi, lichen and bacteria.

This study had three main aims: 1) To quantify microhabitat characteristics that best support moss and biocrusts; 2) To quantify changes in species diversity, community assemblage and cover on an urban gradient; 3) To identify species for future experiments in multi-stress tolerance involving light, pollution and desiccation.

Value of dynamic multi-species modelling for avoiding ecosystem collapse

Holden M[1]
[1]*University of Queensland*

Biography:
Dr. Matthew Holden is an applied mathematician, Research Fellow, and Lecturer at the University of Queensland's ARC Centre of Excellence for Environmental Decisions and Centre for Applications in Natural Resource Mathematics. He uses dynamic models and decision theory to improve conservation planning with special interests in harvested systems.

Because fishers harvest many species that interact with one-another, not considering these interactions can lead to ecosystem collapse. With future harvests and iconic marine ecosystems at stake, one might expect that fisheries are managed using state of the art models to mitigate risk. However, only two out 1,250 published fish stock assessments around the globe include the dynamics of more than one species; and only 24 incorporate any ecosystem components at all. While there are a few examples of successful uses of ecosystem-based fisheries modelling behind the academic ivory tower, there is a clear barrier to using them for real-world decisions. I argue that this is because no one has convincingly demonstrated the general value of ecosystem-based management models for harvest decisions. In this talk, I present preliminary results from a virtual-reality experiment, which demonstrates some of the most critical challenges we face, when trying to forecast harvest-induced ecosystem-collapse.

Vegetation Responses to Extreme Wetting and Drought Events in Central Australia: A View from Space

Huete A[1], Cleverly J[1], Leng S[1], Xie Q[1], Jones L[2]
[1]University of Technology Sydney, [2]University of Montana

Biography:
Alfredo Huete is a Distinguished Professor who uses satellite data to better understand terrestrial ecological processes, phenology and public health. He has 25 years experience serving on NASA science missions teams and in developing satellite products, for which he has received 3 service and group achievement NASA awards.

Identifying ecologically sensitive areas and pending ecosystem collapse amidst climate variability and extreme events, is of global importance. In 2010-11, a significant wetting event produced widespread greening in central Australia and resulted in an exceptionally large land carbon sink anomaly. In early 2017, another intense wet pulse, of greater magnitude than 2010-11, was recorded in central Australia. Satellites provide a unique vantage point from space to observe vegetation dynamics to extreme events, and here a comprehensive array of satellites was used to characterise vegetation growth, photosynthesis, plant stress, and soil moisture, with the objective of tracing the spatial and temporal patterns of greening and drying. Varying sensitivities and recovery rates, related to vegetation functional types, were found and compared with eddy-covariance flux measures gross ecosystem productivity. Satellite data show 2017 as the largest greening event since 2000 with complex spatial patterns of greening and drying attributed to tree-grass extents.

Renewal Ecology: Conservation for the Anthropocene

Hughes L[1]
[1]Macquarie University

Biography:
Professor of Biology and Pro Vice-Chancellor Research at Macquarie University. My research has mainly focused on the impacts of climate change on species and ecosystems. I am a Director of WWF-Australia, a Councillor with the Climate Council of Australia, and a member of the Wentworth group.

The scale and speed of environmental change is challenging traditional conservation and management practices. At the same time, human responses to global change, such as migration, building of protective infrastructures, and land use change, are having their own negative environmental impacts. Attempts to turning back the clock to historical ecological conditions will progressively become more difficult as environmental changes accelerates over coming decades. But human adaptation to rapid ecological change can be explicitly designed to benefit biodiversity, an approach dubbed "renewal ecology". This talk will provide examples of positive interventionist actions that have win-win outcomes for both human and natural systems.

Loss of kelp-bed habitat in Australia: Dissimilar mechanisms in different regions all relate to climate change

Johnson C[1]
[1]*Institute for Marine & Antarctic Studies*

Biography:
Craig Johnson's research is concerned with the dynamics of marine ecosystems, focusing largely on temperate and tropical reefs, but more recently including ecological dynamics of the Southern Ocean. A unifying theme of his recent work is to discern 'tipping points' in marine systems and identify management options to avoid them.

Kelp beds are among the most productive habitats on earth, support high biodiversity, and provide a range of key ecosystem services for humans. However, in Australia there have been significant losses of kelp in eastern Tasmania, northern NSW, and Western Australia. While the mechanisms have been different in each location, in all cases the kelp loss is related to ocean warming. In eastern Tasmania loss of dense surface canopies of giant kelp (Macrocystis pyrifera) to ~5% of previous coverage is associated with warming over decadal time scales, while extensive loss of Ecklonia radiata is the result of overgrazing by a sea urchin that expanded its range southward with ocean warming. In Western Australia, extensive loss of E. radiata has been triggered by circumscribed heatwave events, while in northern NSW losses of this kelp species appear to be driven by southward range extension of sub-tropical herbivorous rabbit fishes.

Ecosystem collapse: from science to policy

Keith D[1]
[1]Unversity of NSW

Biography:
David is an ecologist and conservation biologist with research interests in ecosystem change and risk assessment. He also has considerable experience on government and international committees advising on environmental policy.

The collapse of ecosystems is an issue of wide public concern with implications for both biodiversity and human well-being. Yet environmental policies have yet to address the risks of ecosystem collapse, with legislation and other instruments, failing to distinguish collapse from concepts of species extinction. Part of the challenge is that collapse may be expressed very differently in contrasting systems. The nature of ecosystem collapse and the conditions that lead to it have received increasing research attention in recent decades. Although there is still much to learn, concepts of ecosystem collapse, adopted recently by the IUCN in its Red List of Ecosystems protocol, offer an opportunity for consistent interpretation and synthesis across terrestrial, freshwater and marine ecosystems. In this presentation, I will discuss why a quantifiable concept of collapse is integral to ecosystem risk assessment and how the IUCN's concept is relevant to the Australian environmental policy.

Changes in health of Windmill Islands vegetation: a decade of monitoring

King D[1], Wasley J[2], Ryan-Colton E[1], Benny T[1], Lucieer A[3], Chisholm L[1], Robinson S[1]
[1]University of Wollongong, [2]Australian Antarctic Division, [3]University of Tasmania

Biography:

Diana King is a PhD candidate in the Centre for Sustainable Ecosystem Solutions, University of Wollongong. Her research examines how Antarctic vegetation communities are responding to climate change, and how to use GIS and object based image analysis (OBIA) techniques to enable monitoring of vegetation composition change in these communities.

Continental Antarctic vegetation communities are good baseline environments for climate change research, with little human impact, simple trophic structures and fewer interactions than more complex ecosystems. In order to help to inform policy and management of vegetation in the Australian Antarctic Territory, recent vegetation changes in the Windmill Islands region of East Antarctica were monitored. Moss health state changes were observed between healthy, stressed and moribund over a decade (2003-2013) of repeat long-term vegetation monitoring at two sites in the Windmill Islands (ASPA 135 and Robinson Ridge).
Moss health declined in 2008, following a stress event, then improved by 2013, returning to baseline health levels at ASPA 135 and 2/3 of baseline health at Robinson Ridge, although moribund moss increased at both sites. This indicates that these vegetation communities are resilient, however moss can become moribund if there is stress of high intensity or for extended periods.

Using ecology to inform urban marine designs in a changing climate

Mayer-Pinto M[1], Dafforn K[2], Johsnton E[1]
[1]EERC, BEES, The University of New South Wales, [2]Macquarie University

Biography:
Mariana is an Early Career Researcher whose research broadly focuses on human impacts on marine ecosystems. Mariana uses ecological theory and experimental field ecology to understand the mechanisms by which anthropogenic stressors affect biodiversity and ecosystem functioning across a range of marine habitats, with a strong focus on solution-based research.

Climate change and urbanisation are applying compounding pressures on coastal ecosystems causing the most severe and widespread suite of challenges faced by any marine ecosystem. If we are to retain the services and inherent value provided by coastal ecosystems, we require transformative management practices to alleviate pressures. We argue how climate effects must be mitigated with latitude-specific strategies that prioritise physical interventions in the tropics and biological interventions in temperate zones, by applying ecological theories to the design of adaptive strategies for built infrastructure. Future-proofing our coastlines will require the consideration of temporal and spatial variability of ecological systems, particularly in relation to their biodiversity and connectivity, as a routine component of coastal infrastructure planning and construction. By adopting a new perspective on how and where to build, taking into account future climates, we can engineer resilience, translating theory into practical application and driving effective, forward-looking conservation strategies.

Making ecosystem management decisions when we know almost nothing

McDonald Madden E

Imagine you are given a budget and asked to manage an invasive pest on an island. Easy, we can use dynamic modelling, statistics and optimization to choose the most cost effective management actions for achieving our objective. But now imagine you have no dynamic models to run and no data to analyse? Can math help in this case, or are we stuck using our gut feeling? This situation may sound a bit extreme, but more often than not, this is the usual situation managers find themselves in. In this talk we will explore how we can help aid ecosystem management, even in the case when we know almost nothing about the system.

Detecting and interpreting critical transitions in biodiversity

McGeoch M[1]
[1]Monash University

Biography:
Melodie McGeoch is an ecologist and conservation biologist. Her research integrates spatial ecology with understanding global change impacts on biodiversity. She is interested in methods of quantifying and predicting biodiversity patterns, and the use of these for addressing environmental problems; http://melodiemcgeoch.com/.

Our view of critical transitions in biodiversity is largely formed by spatially extensive, often rapid loss or gain in species abundance or biomass. Such shifts are also usually considered to include an element of irreversibility and a change in ecosystem function. However, extensive range expansions and contractions, complete turnover in species composition, and replacement of specialist with generalist interaction partners in networks are relatively commonplace in nature at multiple scales. Can anything be learnt about critical transitions from the multitude of more general ecological transitions that we regularly observe? I will examine this question using a range of population and community approaches to quantifying and modelling ecological transitions, and applied to problems from biological invasion, rapid declines in species conservation status, and changes in parasitoid metawebs.

Predicting and responding to future change in biodiversity composition and ecosystem function

Mokany K[1], Harwood T[1], Ferrier S[1]
[1]*CSIRO*

Biography:
Karel Mokany is a research scientist who focuses on developing, testing and applying new macroecological modelling approaches to improve understanding and management of biodiversity. He is particularly interested in better incorporating important ecological processes into macroecological modelling techniques.

Rapid ongoing climate change and landuse intensification places increasing pressure on natural systems, in maintaining both their unique biodiversity and functioning ecosystems. Modelling represents a useful tool in improving our understanding of possible changes into the future and formulating robust management responses. However, modelling of biodiversity composition has largely been undertaken separately from modelling of ecosystem function, despite growing evidence that natural systems are shaped by the interaction of composition and function. Using examples from our recent and ongoing research, we demonstrate the insight and predictive capacity gained by incorporating ecosystem processes and functioning with models of biodiversity composition. Our research highlights places and times in which surprisingly dramatic changes in community composition and ecosystem function are expected. We also demonstrate how this more integrated approach to modelling natural systems can be used to help identify robust management strategies likely to retain diverse functioning ecosystems into the future.

Future proofing conservation: capacity building for protected areas management under climate uncertainty

Munera C[1], Van Kerkhoff L[1], Dunlop M
[1]Australian National University, [2]CSIRO

Biography:
Claudia is a conservation biologist with experience in biodiversity and conservation science, climate change adaptation, sustainable development and environmental policy in Colombia and Central America from the local to institutional levels. Claudia is working in the Conservation Futures Project, looking to support adaptive governance for protected areas management in Colombia

Conservation of biodiversity has traditionally been concerned with preserving and restoring biodiversity and ecosystems features; however, climate change brings new and inevitable ecological transformation, where this traditional approach may no longer be possible, challenging existing conservation strategies and governance. Protected area managers must be ready to understand, react and accept the changes in the ecosystems they protect as the climate changes. Conservation Futures is a largely collaborative process between academy, practitioners, and advocacy organisations that looks to introduce innovative strategies to develop capacities that help protected area managers mainstream anticipatory climate adaptation thinking in conservation policy. The process is a multi-step, interactive, dialogue-based series of activities that encourages conservation practitioners to anticipate ecosystem transformation and explore alternative management approaches. Here we present results of the implementation in Colombia, were participants were able to think about future conservation differently, identify processes they could implement to improve and address future governance challenges.

How do species interactions and ecological complexity modify the effects of ocean acidification and warming on marine species and ecosystems?

Nagelkerken I[1]

[1]*The University of Adelaide*

Biography:

I am an ecologist studying the effects of climate change and ocean acidification on marine ecosystems and species.

Our understanding of the ecological imprint of climate change is largely based on reports of negative effects on single species in simplified laboratory systems. I discuss some of our recent studies, using aquarium experiments, mesocosms, and natural CO2 vents, that have incorporated species interactions and ecological complexity. These reveal that species interactions can buffer or enhance negative impacts on communities. Indirect effects that are often neglected, have large impacts on how species respond to a changing environment, e.g. through altered species-habitat and food-web interactions. Additionally, species may show negative stressor responses when studied in simple set-ups, but the inherent complexity that exists in nature allows for compensatory processes. For some species this can boost their population sizes, but for more sensitive species the impacts are negative, leading to loss of biodiversity. In sum, complex processes and species interactions modify the impacts of future climate on marine species and their communities.

Developing a standardized definition of ecosystem collapse for risk assessment

Nicholson E[1], Bland L[1], Rowland J[1], Keith D[2]
[1]Deakin University, [2]UNSW

Biography:
My research focusses on solving problems in biodiversity conservation. My current research interests include measuring change in biodiversity, predicting the impacts of change, and making conservation decisions. I also work on ecosystem risk assessment, and relationships between risks to ecosystems and the benefits they provide.

The difficulty of defining ecosystem collapse has challenged the classification of threatened ecosystems. The International Union for Conservation of Nature (IUCN) Red List of Ecosystems is a powerful tool for classifying threatened ecosystems, informing ecosystem management, and assessing the risk of ecosystem collapse. We systematically reviewed evidence for ecosystem collapses in two contrasting biomes – marine pelagic ecosystems and terrestrial forests. Most studies define states of ecosystem collapse quantitatively, but few studies adequately describe initial ecosystem states, or ecosystem processes leading to collapse. On the basis of our review, we offer four recommendations for defining ecosystem collapse in risk assessments: (1) qualitatively defining initial and collapsed states, (2) describing collapse and recovery transitions, (3) identifying and selecting indicators of collapse, and (4) setting quantitative collapse thresholds. Our recommended framework can be applied to define ecosystem collapse in IUCN Red List of Ecosystems assessments and national ecosystem risk assessments.

Ecosystem surprises and collapse: designing pathways to diminish disaster

O'Connell D[1], Maru Y[1], Grigg N[1]
[1]CSIRO

Biography:
Deborah originally trained in agriculture, ecology and hydrology. These days she leads interdisciplinary and transdisciplinary projects in the area of food-water-energy security, resilience and adaptation pathways, disaster mitigation and sustainable development.

Regions are caught between development needs, conservation goals and global changes (climate, the global economic system, migration, technology, social trends). As a consequence, the social and ecological systems upon which we all depend are changing at unprecedented rates, and in unfamiliar and unpredictable ways. There are no "off the shelf" tried-and-tested recipes for how to manage these changes and avoid the disasters that could eventuate when ecosystems reach thresholds. We present the Resilience, Adaptation Pathways and Transformation (RAPT) Approach to designing pathways (sequenced actions and investments), which can be used to move towards Sustainability Development Goals. The approach is transdisciplinary, drawing on both biophysical and social sciences, while being open to including the arts and humanities, as well as science-based evidence, to engage both imagination and emotions in moving towards more desirable future pathways. We illustrate the approach with practical examples across projects in Africa, Asia and Australia.

Recent ecological change in Australia: are people perceiving climate-related changes in their local biodiversity and ecosystems?

Raisbeck-Brown N[1], Prober S[1], Porter N[1], Leviston Z[2], Norman E[3], Dickson F[3], Williams K[4]
[1]CSIRO Land and Water, [2]Edith Cowan University, [3]Department of Environment and Energy, [4]CSIRO Land and Water

Biography:
Nat is an experimental spatial scientist with 20+ years' experience working with spatial/ecological data in land management and conservation. She is passionate about spatial and ecological data management and linking the two for enhanced analysis and visualisation.

Effective ecological management to promote resilience to climate change requires an understanding of the how climate change is likely to impact on biodiversity and ecosystems. There has been considerable investment in modelling approaches to project such impacts, however, demonstrating the ecological impacts that are actually occurring is challenging in Australia because of the limited availability of long-term ecological data. As an alternative potential source of knowledge, we invited people from across Australia with strong links to Australian environments (including farmers, natural resource managers, ecologists, and naturalists) to participate in an online survey, to share their perceptions of recent ecological change in a place they know well, and how these changes might link with climate change. Here we report perceptions of 300 survey respondents of how biodiversity and ecosystems have been changing in different parts of Australia over recent (10-20 year) timeframes, including some of the anecdotes people shared with us.

The Australian Ecosystem Models Framework

Richards A[1], Dickson F[2], Prober S[1], Roxburgh S[1], Cook G[1], Metcalfe D[1], Murphy H[1], Warnick A[1], Williams K[1], Doherty M[3]

[1]CSIRO Land and Water, [2]Department of the Environment and Energy, [3]Australian National University

Biography:

Dr Anna Richards is a plant and soil ecologist based at CSIRO Land and Water, and Ms Fiona Dickson develops innovative monitoring and reporting tools through the Biodiversity Conservation Division of the Department of the Environment and Energy. Together they lead the collaborative AusEcoModels project.

In order to effectively manage our environment, decision makers require an understanding of ecosystem attributes, including the dynamic characteristics and drivers of ecosystems in reference and modified condition states. To this end, the Australian Ecosystem Models Framework Australia is developing a nationally consistent approach to classifying ecosystems, their condition states and dynamics. We describe the structure of the framework and its conceptual underpinning, including a disturbance-based typology of ecosystems and nested state and transition models which describe recent and transformative anthropogenic impacts on ecosystems. This framework will enable improved assessment of ecosystem health, inform more effective national environmental policy and investment prioritisation, as well as support development of predictive modelling of ecosystems under rapid climate change. We use a case study from an expert-derived conceptual model of an East coast floodplain vegetation complex to illustrate how the framework can be applied at both continental and local scales.

Biodiversity transformations in Antarctic terrestrial ecosystems

Robinson S[1], Waterman M[1], King D[1], Turnbull J[1], Ashcroft M[1], Bramley-Alves J[1], Ryan-Colton E[1], Wasley J[2], Hua Q[3]

[1]University of Wollongong, [2]Antarctic Conservation and Management Program, Australian Antarctic Division, [3]Australian Nuclear Science and Technology Organisation (ANSTO)

Biography:

Sharon is a Climate Change Biologist. PhD in Plant Biology at University College London. Postdocs at Duke University and ANU. Currently Associate Dean Graduate Research and Senior Professor in Biological Sciences, University of Wollongong.

Member of United Nations Environment Programme Environmental Effects Assessment Panel and Editor for Global Change Biology.

Antarctica has experienced major changes in temperature, wind speed and stratospheric ozone levels over the last 50 years. Whilst the Antarctica Peninsula has shown rapid warming and consequent ecosystem change, East Antarctica appeared to be less impacted. Detecting the biological effects of Antarctic climate change has been hindered by the paucity of long-term data sets, particularly for organisms that have been exposed to these changes throughout their lives. We have shown that radiocarbon signals preserved along shoots of the dominant Antarctic moss flora can be used to determine accurate growth rates over several decades, allowing us to explore the influence of environmental variables on growth and providing a dramatic demonstration of the effects of the recent climate change. These findings highlight the importance of developing a robust Antarctic terrestrial and near-shore observing network and considering the efficacy of the current protected areas across the Antarctic continent to adequately protect biodiversity.

Evolutionary enlightened conservation: improving biodiversity outcomes under climate change

Sgro C[1], Cook C[1]
[1]*Monash University*

Biography:
I am an evolutionary biologist, interested in understanding the genetic basis of adaptation to environmental change. I am also interested in exploring how evolutionary processes can be explicitly incorporated into biodiversity conservation and management.

Despite wide acceptance that conservation could benefit from greater attention to principles and processes from evolutionary biology, little attention has been given to quantifying the degree to which relevant evolutionary concepts are being integrated into management practices. There has also been increasing discussion of the potential reasons for a lack of evolutionarily enlightened management, but no attempts to understand the challenges from the perspective of those making management decisions. In this study, we asked conservation managers and scientists for their views on the importance of a range of key evolutionary concepts, the degree to which these concepts are being integrated into management, and what would need to change to support better integration into management practices. We will discuss the outcomes of this study in the broader context of biodiversity management and policy under climate change.

Climate change effects in ecosystems with non-linear environmental gradients.

Stark J[1], Raymond B[1], Clark G[2]
[1]Australian Antarctic Division, [2]Applied Marine and Estuarine Ecology Evolution & Ecology Research Centre University of New South Wales

Biography:
Jonny is a marine ecologist working on the conservation and management of Antarctic coastal ecosystems, from applied environmental science to ecological processes and interactions. In particular, how benthic communities respond to environmental change, from human impacts to climate, across a spectrum from microbial to macrofaunal and macroalgal communities and fish.

Ecosystems subject to non-linear environmental gradients face risk of tipping points or rapid collapse with climate change. One example comes from shallow polar marine waters, where annual changes in light are non-linear, from 24 hours light in summer, bracketed by periods of rapid non-linear increase/decrease in light, to almost no light in winter. Seasonal sea ice (and snow cover) blocks sunlight reaching benthic ecosystems, but the effect of this on the annual light budget reaching the seabed depends critically on the timing of cover within the annual solar cycle. Climate conditions (temperature, wind) that brings the date of ice-loss closer to midsummer will cause an exponential increase in the amount of sunlight per year reaching the seabed. This is likely to drive ecological tipping points in which primary producers (plants and algae) flourish and out-compete invertebrate dominated communities, causing extensive regime shifts, reducing coastal biodiversity and fundamentally changing ecosystem functioning.

Developing a framework for assessing regime shift dynamics in ecosystems

Ward D[1,2], Melbourne-Thomas J[2,3], Johnson C[1], Hindell M[1,2], Wotherspoon S[1,3], Constable A[2,3]
[1]Institute of Marine & Antarctic Studies, University of Tasmania, [2]Antarctic Climate & Ecosystems CRC, University of Tasmania , [3]Australian Antarctic Division, Department of Environment and Energy

Biography:
Delphi Ward is a PhD candidate at IMAS and ACE CRC, University of Tasmania. Her project aims to evaluate the likelihood of regime shifts in Southern Ocean ecosystems, and in doing so she has developed methods for predicting and detecting regime shifts.

The potential for fundamental changes in ecosystem structure and function – ecological regime shifts – is of great concern for many ecosystems. However, so far there is no unifying approach for ecologists and ecosystem managers wanting to evaluate an ecosystem for evidence of past regime shifts or the risk of future regime shifts. We reviewed both the theoretical and ecosystem case study literature to identify what ecosystem qualities increase risk of regime shifts, and current capabilities for predicting and detecting regime shifts. We particularly aimed to identify methods that are currently available, and to highlight improvements in methodology or data collection which are required to improve our capability in predicting or detecting regime shifts. In this presentation, we provide a framework for assessing and monitoring the likelihood of regime shifts in ecological systems. We then present Southern Ocean pelagic ecosystems as a case study for the application of this framework.

Ecosystem collapse of Georgina gidgee woodlands is predicted based on an IUCN Red List of ecosystems assessment

Wardle G[1], Dickman C[1], Greenville A[1]
[1]*The University of Sydney*

Biography:
I am a Professor of Ecology and Evolution at the University of Sydney and co-lead the Desert Ecology Research Group. I study the dynamics of populations, species and ecological interactions with a focus on plants. I apply this knowledge to the conservation and management of ecosystems, particularly deserts.

Georgina gidgee woodlands are widespread across central Australia but occur in relatively small patches of a few hectares. The risk status of Georgina gidgee woodlands was vulnerable based on the degradation of abiotic and biotic processes. Bioclimatically suitable habitat was predicted to decline by at least 30% in eight scenarios over the period 2000 to 2050, and by 95% in the worst-case scenario. Pressures from grazing, weed encroachment and altered fire regimes further threaten the ecosystem; therefore, vulnerable status was also recorded for future declines based on altered biotic processes. Accurate mapping and monitoring of the study ecosystem should receive priority to inform conservation decisions, and sustainable grazing practices encouraged.

Our findings highlight the importance of other patchily distributed ecosystems that may also have escaped attention despite their contribution to supporting unique biodiversity and ecosystem services. It is timely that environmental monitoring and policy account for these natural assets.

National mapping of biodiversity habitat condition for comparative assessments across regions (i.e. capacity of an area of vegetation to provide the structures and functions necessary for the persistence of plant and animal species that would be expected to occur at that location if it were still in a natural state)

Williams K[1], Dickson F[2], Donohue R[1], Ferrier S[1], Harwood T[1], Lehmann E[3], Lyon P[2], Macfarlane C[4], McVicar T[1], Ozolins M[2], Pinner L[2], Storey R[2], White M[5]

[1]CSIRO Land and Water, [2]Department of the Environment and Energy, [3]CSIRO Data61, [4]CSIRO Land and Water, [5]Department of Environment, Land, Water and Planning

Biography:

Dr Kristen Williams optimises utilization of information to reliably predict patterns of biodiversity distribution and changes in habitat condition to support sustainable natural resource management decisions across scales. For more background, see: http://people.csiro.au/W/K/Kristen-Williams.aspx

The CSIRO and partner researchers, in collaboration with the Department of Environment and Energy, have developed a method that links environmental patterns with remote sensing responses for broad-scale assessment of habitat condition. The beta-product of the Habitat Condition Assessment System (HCAS) project (https://research.csiro.au/biodiversity-knowledge/projects/hcas/) is currently being piloted by the Department for its utility in national assessments. The HCAS project aims to provide Australia with its first consistent, repeatable and cost-efficient national biodiversity habitat condition assessment and reporting capability. It is expected that HCAS will enhance capacity to: (i) identify priority areas for management interventions; (ii) undertake national environmental reporting; and (iii) identify natural and non-natural influences on habitat condition. Here we outline some initial results and insights from application testing and product evaluation.

Positive feedbacks to fire in eucalypt forests: drivers and implications

Zylstra P[1]
[1]*University of Wollongong*

Biography:
Through the University of Wollongong, Phil studies the ways that plant traits affect the flammability of ecosystems, using biophysical, mechanistic modelling. More recently, he has extended this to model wildlife survival in fires, and to investigate the mechanisms behind fire-driven ecosystem collapse.

It is widely assumed that eucalypt forests increase in flammability with time since fire due to the build-up of fuels. Climatic and other factors that increase the frequency of fire would therefore lower the flammability of the forest, providing an internal counter-balance to the external drivers of change.

Fire history analysis has however found that the opposite has been happening across treed landscapes ranging from dry open woodlands to subalpine and tall wet formations. Feedbacks in these are positive, so that increases in fire frequency lead to increases in flammability. When such forests include fire sensitive keystone species such as the tall montane Ash stands, increasing fire frequency may lead to ecosystem collapse.

Using biophysical, mechanistic modelling, I will explain the drivers of positive feedbacks, and their relationships to changing climatic and atmospheric conditions through altered growth rates, leaf morphology, and species composition. Important implications for management arise from this.

A

Adams, M 33
Ainsworth, T 34
Ashcroft, M 24

B

Baker, C 36
Baker, C 33
Ball, M 29
Barrett, R 30
Benny, T 15
Bergstrom, D 27, 25
Blackman, C 49
Bland, L 38
Bowman, D 23
Bowman, D 7
Bramley-Alves, J 24
Broadhurst, L 12

C

Chisholm, L 15
Choat, B 49
Chown, S 43
Clark, G 18, 45
Cleary, A 41
Clements, C 17
Cleverly, J 19
Cochrane, A 28
Connell, S 48
Constable, A 8
Cook, C 44
Cook, G 21

D

Dafforn, K 3
Depledge, M 26
Dickman, C 10, 11
Dickson, C 25
Dickson, F 31, 21, 37
Dixon, K 6
Doherty, M 21
Donohue, R 37
Duke, N 35
Dunlop, M 47

F

Ferrier, S 4, 37
Fielding, K 41
Furlaud, J 7

G

Gallagher, R 14
Greenville, A 10, 11
Griffin, K 18
Grigg, N 42

H

Hames, F 39
Harwood, T 4, 37
Haynes, A 16
Helmstedt, K 33
Hindell, M 8
Holden, M 33
Holden, M 32
Hua, Q 24
Huete, A 19
Hughes, L 2

J

Johnson, C	22, 8	Johsnton, E	3
Johnston, E	18	Jones, L	19

K

Keith, D	40, 38	King, D	15, 24

L

Lehmann, E	37	Li, X	49
Leng, S	19	Lucieer, A	15
Leviston, Z	31	Lyon, P	37

M

Macfarlane, C	37	Medlyn, B	49
Maher, T	14	Melbourne-Thomas, J	8
Maru , Y	42	Metcalfe, D	21
Mayer-Pinto, M	3	Mirzaei, M	14
McDonald Madden, E	46	Mokany, K	4
McDonald-Madden, E	33	Munera, C	47
McGeoch, M	25, 20	Murphy, H	21
McVicar, T	37	Murray, Z	41

N

Nagelkerken, I	13	Norman, E	31
Nicholson, E	38		

O

O’Connell, D	42	Ozolins, M	37

P

Pascovici, D	14	Poore, A	18
Peters, J	49	Porter, N	31
Pinner, L	37	Prober, S	31, 21
Plein, M	33		

R

Raisbeck-Brown, N	31	Roiko, A	41
Raymond, B	45	Rowland, J	38
Richards, A	21	Roxburgh, S	21
Robinson, S	15, 24	Ryan-Colton, E	15, 24

S

Sgro, C 44
Sisson, S 33
Stark, J 45
Storey, R 37

T

Tissue, D 49
Turnbull, J 24

V

Van Kerkhoff, L 47
Vergés, A 18

W

Ward, D 8
Wardle, G 10, 11
Warnick, A 21
Wasley, J 15, 24
Waterman, M 24
Whinam, J 25
White, M 37
Williams, K 21
Williams, K 31
Williams, K 37
Wotherspoon, S 8
Wright, I 14

X

Xie, Q 19

Z

Zylstra, P 5