



Terrestrial Research E-bulletin

Convener's Update

This issue's update on the 'Climate Commission' from co-convenor, Professor Lesley Hughes

As the political "debate" about climate change in Australia hots up and governments and policy makers everywhere grapple with workable solutions, there has never been a more important time for climate science to be effectively communicated. Last February, the Minister for Climate Change and Energy Efficiency, Greg Combet, announced the formation of the Climate Commission, an independent body tasked with communicating three important issues to the Australian public – the science of climate change and the impacts on Australia, the progress of international action dealing with climate change, and the economics of a carbon price.

As one of the six Commissioners, I have been participating in public outreach events around Australia (12 so far with many more to come) as well as producing a series of reports. The first of these, "The Critical Decade" summarised the latest climate science relevant to Australia and was launched in Parliament House in May, receiving bipartisan support. Follow up reports on regional impacts are being progressively released to coincide with the public events.

It's been a very interesting ride so far. For an academic, stepping outside the ivory tower occasionally is one thing, throwing oneself bodily from the ramparts is another. There is clearly a tremendous thirst amongst the Australian public for reliable information about climate change and a great deal of confusion as to which sources of information can be trusted. Our conversations with communities have been lively, challenging but (almost) always enjoyable. Scientists do need to be part of the conversation - just writing papers for learned journals and talking to one's peers is not enough to make a difference. Get out there, it's worth it!



More information about the Climate Commission can be found at :<http://climatecommission.gov.au/>

Download the Critical Decade report at:

<http://climatecommission.gov.au/topics/the-critical-decade/>

We hope you enjoy the rest of this, our 10th issue of TRE -bulletin, with articles on impacts and adaptation in the Northern Territory, a piece on the potential of digging marsupials to help with increasing ecosystem resilience, and a summary of recent research on adaptation in Tasmanian saltmarshes.

Steve Williams & Lesley Hughes

Meet the Steering Committee

Dr Craig James

Craig James leads the Theme on Managing Species and Natural Ecosystems in CSIRO's Climate Adaptation Flagship.



Craig has worked as a desert ecologist for over 20 years and until recently was the General Manager of Research, Communication and Commercialisation for the Desert Knowledge Cooperative Research Centre.

He is a current member of the INTECOL (International Association for Ecology) Board and past President of the Ecological Society of Australia.

In this issue:

Focus on Northern Territory	2
Tasmanian Salt Marshes	3
Must Read	3
Digging Marsupials	4
Conference Update	4

Focus on the Northern Territory

Like most other Australian states, climate change predictions for the Northern Territory cover the gamut of scenarios, including increased temperatures, increased rainfall during the wet season, harsher, drier, dry seasons, and prolonged drought. On top of these general predictions, it is expected that the NT, like Queensland and northern WA, will see more severe cyclones, increased incidence of storm surges and inundation with salt water, and extremely complex interactions between CO₂, weather, and fire regimes. In this issue, we take a look at the potential impacts, and possible adaptation strategies, to climate change for biodiversity and traditional communities, in the Northern Territory.



The fragile freshwater ecosystems of Kakadu are severely threatened by sea level rise and salt water inundation, and compounded by the activities of feral species such as water buffalo and pigs. (© N. Kenyon)

Climate Change and Kakadu

Kakadu is arguably Australia's most iconic National Park and World Heritage Listed Area - it is one of very few WHA to be listed for both its natural and cultural attributes. Made famous worldwide by the Crocodile Dundee movies, more than 200,000 people visit Kakadu each year, bringing in millions of tourist dollars to the Australian economy.

However, Kakadu, and its prized biodiversity (and cultural) values, are under extreme threat from climate change. Perhaps most importantly, climate change is likely to interact with a suite of other threatening factors in Kakadu to potentially increase impact and reduce capacity for resilience and adaptation. These include fire regimes in the savannah, feral animals and plants, and - most crucially - rising sea levels.

Future fire risk in the savannah is expected to escalate, due to interactions between CO₂ levels and plant growth, changes in rainfall timing and intensity, and increases in severe fire weather. The role of prescribed burning to reduce the risk of wildfire is still hotly debated - in particular the best time of the year to burn. The spread of fire prone weeds, such as gamba grass, will compound the problem.

The fragile Kakadu ecosystems rests primarily around the vast wetland areas, which are associated with the Alligator Rivers system, and support a high biodiversity of species, both freshwater and terrestrial. However, climatic changes have resulted in around a 20 cm sea level rise in the region in the past century, and potentially a much greater rise is predicted by 2100. This saltwater inundation has already resulted in loss of many saline intolerant plants and trees, and it is expected this trend toward more saline tolerant species will continue and perhaps increase. Introduced ungulate species, including water buffalo and pigs, increase the intrusion of saltwater by trampling, increasing and enlarging natural low-lying channels that connect wetland areas.

In terms of adaptation for Kakadu, managers are focusing primarily on increasing the resilience of the whole system - through control of invasive species - plants and animals, and working out the best way to reduce the risk of intensive wildfires. Steps have already been taken to reduce the impact of saltwater intrusion by the construction of earthen barrages at the mouth of the Mary River, to the east of Kakadu.

Relocation – a potential adaptation measure for Aboriginal coastal communities? Kerstin Zander, Charles Darwin University.

For climate change policy to be effective there needs to be an understanding of the ways people currently think they will respond to climate change impacts. This has been the subject of my research at Charles Darwin University. With my colleague Lisa Petheram, we worked with the Aboriginal people of north-east Arnhem Land to find out how they would adapt to predicted climate change impacts on their region, including rising sea levels and stronger cyclones.

This was a subject about which many people are already well-informed, from the media, but also from changes they have witnessed over the last decade. Some of the strongest cyclones recorded have passed close to the communities in recent years and every year has seen increasingly severe erosion of beaches. Some places where turtles have been nesting for as long as living memory are no longer suitable and all around the coast beach she-oaks are tumbling into the sea.

The main adaptation strategy discussed was relocation, even if this is only temporary, and many people talked with pride about a traditional lifestyle that was highly mobile. Those who wanted to move permanently said they wished to relocate to traditional lands rather than to any city or town – though they also have a strong attachment to the sea and the resources it provides.

However the respondents to surveys fell into two groups; one group said they would miss the fish and turtles that they now obtain to supplement their current diet, while the other group said they would miss the modern facilities such as stores, hospitals and schools that are currently available in towns where they live.

The key message is that people are already thinking about what they might do, with moving the most likely option. In fact the need to adapt to climate change could help some people meet their aspiration to return to homelands if facilities are also moved. Others wanted to stay but felt better cyclone shelters were needed. All groups, however, also emphasised that climate change is a far less pressing problem than many others they need to deal with, such as the gap in life expectancy between Aboriginal people and other Australians.



Beach erosion in the NT is resulting in loss of biodiversity - and therefore loss of traditional resources for local Aboriginal communities.

Sustaining Saltmarshes in the Tasmanian Coastal Landscape

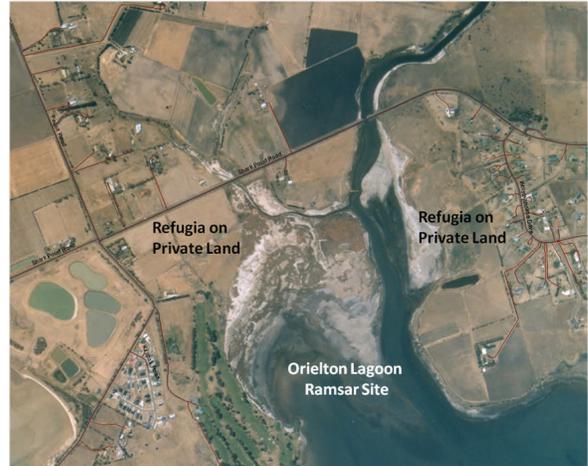
Vishnu Prahalad, University of Tasmania.

Tasmanian coastal saltmarshes and the associated intertidal wetlands form a crucial 'link' between terrestrial and marine systems providing critical ecological functions that support a range of biodiversity values. A large portion of this important coastal ecosystem has already been lost to human development and mismanagement. In addition, climate change and sea level rise have emerged as major threats to the extent and function of the remaining saltmarshes as they mostly occupy shores within 1 m of high water.

Two recent studies in the south east and north west of the State have documented substantial loss of saltmarsh area and habitat quality due to climate change, sea level rise and increasing direct human impacts. These studies have highlighted the need to proactively plan for sustaining saltmarshes and their ecological function in the Tasmanian coastal landscape. A further loss of saltmarshes would have detrimental effects on the larger coastal complex, and these effects will reduce the biodiversity values they support.

While it is clear that saltmarshes need 'accommodation space' to move inland as they respond to climate change and sea level rise, not all saltmarshes can move inland due to numerous practical constraints. Hence, coastal managers need to be advised about ideal locations to direct their management actions to be able to get the best biodiversity conservation outcome.

Work is currently underway to develop a process for creating 'planning overlays' identifying areas of 'high conservation value' for saltmarsh refugia in Tasmania so that saltmarsh function and biodiversity is maintained or improved locally, regionally and across the State. A pilot project was conducted in 2009 to initiate this process for one local area, namely the Derwent Estuary. Currently, another project is being planned for the State's southern region. It is envisaged that this project will provide a renewed purpose and direction for sustaining saltmarshes in the coastal landscape by beginning to answer the questions: 1) Where are coastal saltmarshes likely to remain or establish in the future? 2) Are we providing space, appropriate land-use and on-ground management, to enable saltmarshes to exercise their inherent adaptive capacity in the future as they respond naturally to sea level rise?



Orielton Lagoon Ramsar Site, south east Tasmania, is an important migratory bird habitat. The saltmarshes will need to be accommodated on neighbouring private land with rising sea levels if their ecological function (and services) is to be maintained into the future. (Map by VP; base data from theLIST, State of Tasmania).

More: vishnun@utas.edu.au

Must Read

Hot off the press— papers and reports on climate change adaptation

- ◆ **Who likes it hot? A global analysis of the climatic, ecological, and evolutionary determinants of warming tolerance in ants.** (2011) Diamond *et al.* *Global Change Biology*, (online early). This study models projected physiological thermal tolerances of ants in temperate and tropical regions in order to predict sensitivity to climate change. The authors find that tropical ants have lower warming tolerances and are thus expected to be most at risk - in particular those that inhabit low elevation, warm, mesic forested habitats. DOI: 10.1111/j.1365-2486.2011.02542.x



- ◆ **Beyond climate envelopes: effects of weather on regional population trends in butterflies.** WallisDeFries *et al.* (2011) *Oecologia*, 167, 559-571. Utilising data from the Dutch Butterfly Monitoring Scheme, this study investigates changes to 40 butterfly species over 15 years, with corresponding climatic data. They find evidence that climate, in particular temperature, is associated with regional populations trends - both negative and positive, in many species. The authors also caution that the negative effects of climatic extremes, such as extreme hot, dry weather, are underestimated for many species. 10.1007/s00442-011-2007-z [Open Access](#)

- ◆ **Early Response of the platypus to global warming.** (2011) Klampt *et al.* *Global Change Biology*, 17, 3011- 3018. The authors combine modeling with more than 200 years of distribution records on the platypus to investigate climate driven changes in distribution. They find a strong pattern suggesting a shift in distribution - to more thermally suitable habitat - in the 1960's as the climate began to warm. Predictive models suggest a further large decline in thermally suitable habitat in the future, which, combined with human impacts on wetland areas and water use, could endanger the future of this species. DOI: 10.1111/j.1365-2486.2011.02472.x

Australian Digging Mammals and Ecosystem Health by Leonie Valentine, Trish Fleming, Giles Hardy; WA State Centre of Excellence for Climate Change, Woodland and Forest Health.

Mammals that move or manipulate soil for food or shelter can alter the biotic and abiotic characteristics of their habitat, potentially creating multiple benefits to overall ecosystem and increasing system resilience to change – including climate change.

Australian digging marsupials, such as bandicoots and bettongs, create small, conical-shaped holes while foraging for underground fungi, earthworms and tubers.

They are functionally ecological engineers, and provide an important service that enhances soil water penetration, reduces run-off and can create fertile patches that may increase germination of plant species.

The majority of Australian digging mammals have undergone drastic range and population contractions within the last 100 years. Where ecosystems have lost digging mammals, key processes may be reduced and this may contribute to declines in ecosystem health and resilience.

However, very little research has examined physical properties of mammal-caused foraging pits, or the potential flow-on effects of mammal digging.

'Ecosystem Engineers' - including digging marsupials - may contribute to ecosystem resilience to climate change by:

- * altering the physical properties of soil, including compaction and water infiltration;
- * influencing seed dispersal and germination;
- * effecting the dispersal of mycorrhizal spores which are important for soil and plant associations in an ecosystem
- * altering litter build-up that subsequently affects the patchiness of fire.



Southern brown bandicoots are important ecosystem engineers due to their digging activity (inset: © L.Valentine).

Understanding the relationship between forest health and mammals is essential for conservation management of both mammal species and restoration of the woodlands, and could contribute to understanding how these species can contribute to climate change adaptation.

A new study at the WA State Centre of Excellence for Climate Change, Woodland and Forest Health, will investigate the ecological impacts of mammal foraging pits on soil condition, water infiltration, seedling recruitment, fungi dispersal and fire dynamics – with direct application to climate change adaptation strategies.

More: l.valentine@murdoch.edu.au

Conference Update

Planet Under Pressure 2012. London, UK. 26-29 March 2012. Abstract submission closed. Early Bird Registration by 20 Jan 2012. www.planetunderpressure2012.net

Adaptation Futures: Second International Climate Change Adaptation Conference. Arizona, USA, 29-31 May 2012. **Abstract Submissions by 30 Jan 2012.** <http://www.adaptation.arizona.edu/adaptation2012>

HydroPredict 2012: Water resources and a changing global environment. Vienna, Austria. 24-27 September 2012. **Abstract submissions by 1 February 2012.** <http://web.natur.cuni.cz/hydropredict2012>.



About the Adaptation Research Network for Terrestrial Biodiversity

The Adaptation Research Network for Terrestrial Biodiversity is one of eight Research Networks administered by the National Climate Change Adaptation Research Facility - www.nccarf.edu.au.

It is hosted by James Cook University in Townsville.



Convenors:

Prof. Steve Williams
Ph.: +61 (0)7 4781 5580
stephen.williams@jcu.edu.au

Prof. Lesley Hughes
Ph.: +61 (0)2 9850 8195
lhughes@bio.mq.edu.au

Coordinator:

Dr Yvette Williams
Ph.: +61 (0)7 4781 5552
yvette.williams@jcu.edu.au

TRE Editor:

Dr Jo Isaac
joanne.isaac@jcu.edu.au

Our Website

www.nccarf.edu.au/terrestrialbiodiversity

To subscribe to our Network - <http://nccarf.jcu.edu.au/terrestrialbiodiversity/index.php/register>

For more information or to join our Network, please email yvette.williams@jcu.edu.au.

To contribute stories or ideas to TRE, please email joanne.isaac@jcu.edu.au

TB Network Partners



Australian Government
Department of Climate Change

Curtin
University of Technology

