

# Recent climate-driven ecological change in Australia

Rapid climate change poses significant new challenges for natural resource managers. The ability to successfully maintain the health and persistence of Australia's biodiversity will be increasingly dependent on an evolving body of knowledge about the ecological impacts of climate change.



**Snow thawing out and filling the Eucumbene River at Kiandra in New South Wales (Image credit: Arthur Mostead)**

## Background

Over the past century, average land surface temperatures have risen by almost 1° Celsius across the Australian continent. However, the ecological impacts of this change have not been systematically investigated.

In order to develop a more explicit understanding of the link between climate and ecosystem responses, we are collaborating with the Department of the Environment and Energy to examine how and where climate change has influenced Australian patterns of biodiversity over the past 100 years.

## Why is this project a critical research need?

While there has been considerable investment in projecting the potential impacts of climate change on biodiversity and ecosystem distributions under various climate change scenarios in Australia, there have been few studies that have investigated the ecological impacts of the change that has already occurred. Investigating this recent ecological change and using this knowledge to

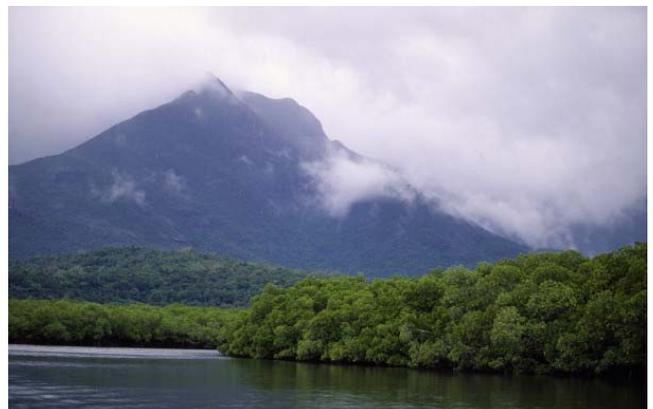
evaluate the capacity of our current models to predict (hindcast) past change will substantially improve our understanding of climate-driven change processes. In addition, it will support interpretation of and confidence in models projecting ecological change into the future.

## How will this be achieved?

This three-year project (to June 2018) will investigate the nature of recent climate-driven ecological responses to change by synthesizing and linking scientific evidence, historical climate data, anecdotal observations, and models of ecological change.

Observations of climate change and impacts on biodiversity and ecosystems will be collected via a national survey of agricultural and natural resource managers, professional and amateur naturalists.

The observations will be used in research designed to test and strengthen the ecological modelling that we have been developing to project patterns of biodiversity change throughout Australia.



**Mist over mountain, west coast of Hinchinbrook Island on the Great Barrier Reef (World Heritage Listed site) (Image credit: Ian Hutton)**



**Magpie geese at a paperbark swamp in Kakadu National Park (World Heritage Listed site) (Image credit: Allan Fox)**

The project will be developed in three parts:

### **National survey of ecological change phenomena**

A national online survey will invite people with strong links to Australian environments (e.g. farmers, natural resource managers, ecologists, naturalists) to share their perceptions of recent ecological change and how this might link with climate change. Along with collation of examples of change from the published literature, this aims to provide a series of anecdotes about what people believe is happening to Australian biota.

### **Modelling and mapping**

Over recent years, CSIRO has been refining a statistical modelling technique, Generalised Dissimilarity Modelling (GDM), for analysing and predicting spatial patterns in biodiversity as a whole over space and time.

The outputs can be applied to a wide range of uses including visualization of spatial patterns in community composition, distributional modelling of species or community types, environmental classification, biological survey gap analysis, conservation prioritisation, and climate-change scenario analysis and impact assessment.

The performance of GDM has been tested in investigations of paleo-historical change to biodiversity patterns, demonstrating its robustness in space-for-time substitution studies. This project extends the use of GDM to hindcast recent change and evaluate those predictions using best-available scientific data and anecdotal observations.

### **Recommendations for strengthening the use of GDM in climate projection studies**

The final part provides insights into the limitations and use of GDM measures for projecting and interpreting future ecological change.

### **Data sources for modelling and mapping**

The biological data used in the models developed through this project will be drawn from the Atlas of Living Australia, and the climatic and environmental data will be based on products available through the Terrestrial Ecosystem Research Network (eMAST and Land Grid).

### **Outputs from the project**

Output datasets from the modelling will be delivered as 0.01 degree (~1 km) grids, and along with a technical report made publically available through CSIRO's Data Access Portal ([www.data.csiro.au](http://www.data.csiro.au)).

Findings from the national survey will also be made available through a publication.

### **How the project will engage stakeholders**

The project team, comprising representatives from the Department of the Environment and Energy and CSIRO, will seek to collaborate with organisations developing and maintaining species location records, environmental surfaces and climate data.

Additionally, information from national survey will be vital to identifying anecdotes of ecosystem change. If you are interested in participating please contact Dr Suzanne Prober (details below).

The project team will hold public seminars to communicate about the project as it progresses.

If you're interested to know more, please contact us (details below) or catch up on the project at <https://research.csiro.au/biodiversity-knowledge/>.



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