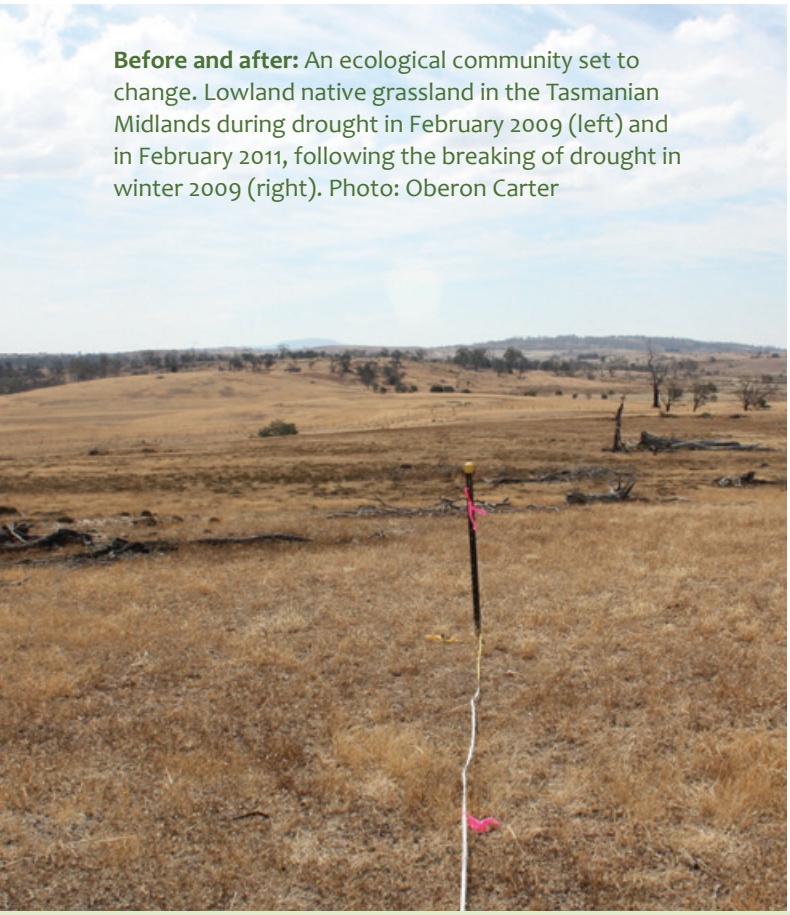

Before and after: An ecological community set to change. Lowland native grassland in the Tasmanian Midlands during drought in February 2009 (left) and in February 2011, following the breaking of drought in winter 2009 (right). Photo: Oberon Carter

Managing Tasmania's endangered grasslands: change is inevitable

- By 2050, the extent of the area that is climatically suitable for Tasmania's lowland grasslands, including those listed as critically endangered, is likely to have shrunk considerably. By 2100, only small areas will remain.
- As the climate becomes less suitable, changes in the species that make up the grasslands may occur, leading to shifts in the structure and habitat quality of the grasslands. Some change is inevitable.
- Conservation managers should focus on maintaining the diversity, structure and function of grassland ecosystems rather than trying to preserve the current species composition of grassland areas. Continual monitoring, and flexible, adaptive legislation and management will be vital.

Research summary

To effectively conserve Tasmania's critically endangered lowland grasslands, we need to know where climatically suitable habitat is likely to persist in the long term.

We modelled the suitability of the future climate for lowland grasslands and found that, by 2050, the extent of the area that is climatically suitable is likely to have shrunk considerably. By 2100, only small areas will remain.

As the climate becomes less suitable, we will see a change in the species that make up the grasslands, and in the structure and habitat quality of the grasslands. Some change is inevitable.

Conservation managers should focus on maintaining the diversity, structure and function of grassland ecosystems rather than trying to preserve the current species composition of grassland areas. Continual monitoring and flexible, adaptive management will be vital.

Tasmania's lowland grasslands

In Australia, lowland temperate grasslands are a national conservation priority, with less than 1% of their original extent remaining.

Tasmania's critically endangered lowland grasslands comprise two types of grassland:

- Lowland Themeda Grasslands, dominated by Kangaroo Grass (*Themeda triandra*)
- Lowland Poa Grasslands, dominated by Tussock Grass (*Poa labillardierei*).

These grasslands are dominated by native grasses, with few or no woody species. Patches in good condition are species-rich and are important habitat for an array of plants and animals, many of which are listed as vulnerable or threatened.

The climate of the future – will it remain suitable?

To effectively conserve Tasmania's lowland grasslands, we need to know where climatically suitable habitat is likely to persist in the long term.

Average temperatures in Tasmania are projected to increase by between 2.6 °C and 3.3 °C by the end of this century under a high emissions scenario. In many parts of Tasmania where the grasslands now grow, annual rainfall is expected to increase slightly and the seasonality of rainfall is expected to change. For example, after 2050 we can expect much wetter autumns and drier springs in the south-east of Tasmania. These changes will affect the extent of the area that is climatically suitable for temperate grasslands.

The fate of the grasslands

We modelled current and future climatic suitability for communities of Lowland Themeda Grassland and Lowland Poa Grassland; the two dominant grass species of these grasslands (Kangaroo Grass and Tussock Grass); and closely related grassland and woodland communities, which contain many of the same species as the grasslands.

Our findings are based on climate projections which the Climate Futures for Tasmania project downscaled to 10 kilometres and which we then interpolated to one kilometre. We used six global climate models under a high emissions scenario (A2); global emissions are currently tracking the upper level of this scenario.

The area climatically suitable for grasslands will shrink

All six climate models project a strong contraction of climatically suitable area for both the Lowland Themeda and Poa grassland communities by 2050. Only small areas within the current distribution are likely to remain climatically suitable by the end of the century and very little of that area is currently in good condition.

Almost none of the current Lowland Themeda Grasslands area will be climatically suitable by 2080.

The future of the Lowland Poa Grasslands looks slightly better, with some very small areas of good-condition grasslands expected to remain climatically suitable by the end of the century.

For the two dominant species, Kangaroo Grass and Tussock Grass, the climate is likely to remain suitable until mid-century, but by 2080 it will become less suitable in the current grassland areas.

Recolonisation is unlikely

New areas may become climatically suitable, but it is highly unlikely that the grassland community as a whole will be able to move beyond its current extent because native vegetation is highly fragmented in the agricultural landscape, and in many areas the soils are not suitable. Importantly, the change in climate is likely to be too rapid for many species to recolonise new areas.

A change in species is likely

As the climate becomes less suitable for lowland grasslands, a change in species composition and dominance is likely as some species are replaced by others. Species will respond differently, and at different times and rates.

Some plant species may adapt, some won't

Some species may be able to adapt to changing conditions by altering their physiology, their behaviour or the timing of their lifecycle events, such as flowering. Nearly 40% of the Tasmanian grassland plants are herbaceous perennials, annuals and ephemeral species that do well in open and dry environments, and may have traits that allow them to adapt to the new conditions. Many of them have broad temperature and rainfall tolerances.

On the other hand, some grassland plant species found only in Tasmania have highly specific habitat requirements or narrow temperature tolerances, and may become locally extinct.

Options for conservation managers

Rethink conservation priorities

Currently, conservation focuses on trying to maintain lowland grasslands as they currently exist. This is unlikely to be a viable management option in the long term.

In areas where the climate is projected to become unsuitable, conservation managers should instead focus on maintaining natural processes and interactions between animals, plants, climate and environment — the 'ecosystem function'. This is particularly important for grasslands that are currently in good condition because these grasslands are likely to be the most resilient to change in the short term and the most adaptable in the long term.

Minimising further fragmentation and preventing weed invasion and stress from other land uses will be essential. Applied burning or ecologically sensitive grazing may help to maintain, or even improve, grassland condition, and maximise the chance of a functioning, predominantly native, grassy ecosystem persisting in the long term.

Have flexible legal and policy instruments

Mechanisms for protecting grasslands currently include formal reservations, long-term conservation covenants and stewardship agreements. Under these mechanisms, there is a legal requirement to manage the grasslands under particular regimes, with success judged by indicators such as the abundance of listed species. As the climate changes, this may no longer be appropriate.

Legal and policy instruments will need to be more flexible to allow for changes, while still protecting the species-rich communities of high conservation value. By the end of the century, few lowland grasslands may match the description contained in the 2009 legislation, but there may well be healthy native, grassy vegetation that could be considered a conservation priority.

Monitor and adapt management in response to change

Conservation managers will need to continually monitor grassland communities to track changes as they occur and to document how the grasslands respond to extreme events, which may indicate the future trajectory of the community.

Adaptive management with the flexibility to modify strategies and take pre-emptive action will be vital.

Some grassland plant species found only in Tasmania have highly specific habitat requirements or narrow temperature tolerances, and may become locally extinct.

Where to from here?

Collaboration with the Tasmanian Government Department of Primary Industries, Parks, Water and Environment has resulted in this modelling approach being applied to other vegetation communities across Tasmania. The results have been used to stimulate discussion with natural resource management groups and non-government organisations in Tasmania about the potential impacts of climate change on vegetation communities. The results have also been combined with social data on the adaptive capacities of land managers, to inform the design of conservation engagement programs.

Who are the researchers?

Dr Rebecca Harris

Bec has an extensive background in field ecology and thermal biology. As part of our Climate Futures Project, she works closely with researchers across the hub to extract, analyse and interpret climate projections for species under threat from climate change.

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Oberon works for the Tasmanian Government Department of Primary Industries, Parks, Water and Environment. He has a particular interest in the management of biodiversity refuges in the face of climate change, and specialises in integrating spatial data.

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Collaborators

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Further reading

Harris RMB, Carter O, Gilfedder L , Porfirio L, Lee G & Bindoff N (in review) Noah's Ark conservation will not preserve threatened ecological communities under climate change. *PLoS ONE*.

About the NERP Landscapes and Policy Hub

The Landscapes and Policy Hub is one of five research hubs funded by the National Environmental Research Program (NERP) for four years (2011–2014) to study biodiversity conservation.

We integrate ecology and social science to provide guidance for policymakers on planning and managing biodiversity at a regional scale. We develop tools, techniques and policy options to integrate biodiversity into regional-scale planning.

The University of Tasmania hosts the hub.

www.nerplandscapes.edu.au

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