



Credit: Louise Romanin

## Tasmanian eucalypts: will they survive the hotter, drier summers?

South-east Australia is expected to become drier and hotter over the next 100 years, which will affect the eucalypt forests of Tasmania.

Forests will be less dense, especially on the east coast and in the Midlands. In these areas, also, the climate is likely to become unsuitable for a number of endemic eucalypt species.

As eucalypt forests become more open, they will store less carbon. There are also implications for managing wildfires.

Anyone planting eucalypts should choose species that will thrive in the climate of the future, not the climate of the present.

## Research findings

- » Tasmania's eucalypt forests will persist in the hotter, drier climate of the next 100 years, but canopy cover will change, with implications for storing carbon and managing fire.
- » Some endemic species will struggle to survive.
- » Anyone planting eucalypts should choose species that will thrive in the climate of the future, not the climate of the present.

## Why did we do this study?

### Tasmania is expected to become hotter and drier

Tasmania has a range of diverse landscapes and an equally complex range of climates. Westerly winds bring high rainfall, year round, to the mountainous west coast; the less mountainous east coast has a drier, temperate climate; and the Midlands, a north-south valley in the centre of the island, is in a dry 'rain shadow', protected from the prevailing westerlies.

In the future, Tasmania's climates are expected to become more like those presently experienced in mainland Australia, due to rising temperatures, and changes to wind patterns and rainfall. Severe droughts are likely to be more frequent.

### Eucalypt forests struggle in severe drought

Tasmania has 29 species of *Eucalyptus*, 16 of which are endemic. In uncleared areas of the Midlands we find dry eucalypt forest, while at the wetter end of the state the world's tallest flowering plant, *Eucalyptus regnans*, grows in the most carbon-dense forests on earth. These forests provide valuable services such as storing carbon and providing habitats for a diversity of plants and animals.

Over the last century, large areas of the Midlands have been cleared. Efforts to re-establish forests are underway, on both public and private lands. Eucalypt forests struggle in severe drought, so the question is whether the species of eucalypt being planted will cope with the hotter, drier climate and more frequent droughts projected for Tasmania over the next 100 years.

### Regional-scale climate projections are now available

To date, projections of tree cover in Tasmania have been too coarse, spatially, because they were based on coarse climate projections from global climate models or extrapolated from historical climate trends. Recently, finer-scale climate projections have become available for Tasmania, giving us the opportunity to assess their impact on the state's eucalypt forests at a regional scale.

## What did we do?

We investigated how the density of Tasmanian temperate eucalypt forests is likely to change in the next 100 years under a high greenhouse-gas emissions scenario (the 'A2' scenario of the Intergovernmental Panel on Climate Change).

Questions we sought to answer:

- Will the projected climate changes have a substantial impact on Tasmania's eucalypt forests?
- Which areas are most likely to change?
- Will tree cover increase or decrease?
- Will all species of eucalypt tolerate the projected changes in climate?

“Canopy cover is an indicator of tree density, measured as the percentage of ground visible through the canopy from the sky.”

## How did we do it?

### Measuring canopy cover as an indicator of change

'Canopy cover' is an indicator of tree density, measured as the percentage of ground visible through the canopy from the sky. A rainforest, for example, could have close to 100 per cent canopy cover, with very little sunlight reaching the forest floor and, therefore, few shrubs and grasses. Canopy cover can mean the difference between 'closed forest', 'open forest' and 'woodland' and, therefore, has implications for storing carbon and for managing wildfires.

### Modelling canopy cover in the climate of the future

We built a statistical model of canopy cover in south-eastern Australia's native eucalypt forests using MODIS satellite cover measurements, and then applied this model to Tasmania, generating projections using current and future climate data (temperature, rainfall and evaporation). For the future climate, we used regional-scale (resolution of 10–14 kilometres) projections which had been scaled down from three global climate models. Together, the three models provide a good spread of potential outcomes for south-east Australia.

We quantified the area of eucalypt forest likely to experience a substantial change (at least 10 per cent) in canopy cover, and for six eucalypt species (three endemic) we identified the likely change in area.

**Dieback:** Drought can exacerbate dieback in eucalypts, as seen in the foreground of this Midlands landscape.

## What did the results tell us?

### Eucalypt forests will persist but canopy cover will change

Over the next 100 years, the climate across most of Tasmania will remain suitable for eucalypts, and eucalypt forests should persist over much of the state. However, we can expect a net loss of canopy cover, mainly in the Midlands, the driest part of the state. The low-lying regions of the east and north-east of the state have the most potential for a decrease in canopy cover because rainfall will be lower.

### Some endemic species will struggle

While eucalypts on mainland Australia already grow in the climates that Tasmania is likely to experience in the future, some species endemic to Tasmania will struggle in the hotter, drier summers projected for much of the state. The endangered *Eucalyptus gunnii* spp. *divaricata*, or miena cider gum, is already in decline because of more frequent droughts.

### New species may need to be planted

To maintain the current high levels of canopy cover, more trees will need to be planted. New species may need to be introduced, including species currently found only on mainland Australia.

Restoration of eucalypt forests requires selecting species that are most suitable for the future climate rather than the present. Plant trials and genetic studies are underway to identify suitable species.

## Where to from here?

Our projections of eucalypt canopy cover are now being applied in a study to determine the carbon storage potential of the Midlands and strategies for revegetation.



Credit: Louise Romanin

## Who are the researchers?

Dr Grant Williamson



Grant is a landscape ecologist and spatial scientist with the University of Tasmania. He works in the Vegetation and Fire Project team to examine how fire activity varies in Tasmania and the Australian Alps according to landscape, vegetation type, land tenure and management history.

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## Further reading

Williamson GJ, Prior L, Harris R, Grose M & Bowman D (2014) Predicting canopy cover change in Tasmanian eucalypt forests using dynamically downscaled regional climate projections. *Regional Environmental Change*, vol 14, no 4, pp 1373-86.

## 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.

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