Understanding the climate vulnerability of Australia's threatened species

Final report arising from honours project by Jasmine Lee, University of Queensland, 2012

Supported through funding from NCCARF – Terrestrial Biodiversity Network

Supported by Martin Taylor and WWF Australia with a research scholarship

Supervisors: Dr Richard Fuller & Dr Ramona Maggini

Overview

During my NCCARF-funded project I estimated climate vulnerability for 232 of Australia's threatened species. I discovered that a substantial number of these species are vulnerable to climate change, but that the magnitude of this vulnerability varies both spatially and taxonomically. Moreover, the specific factors leading to climate vulnerability, and hence the actions that might be taken to help species adapt to climate change were also highly variable across space and across taxonomic groups, indicating that we will need to plan our climate adaptation response carefully (Figure 1). My results highlight an urgent need to prioritise climate adaptation actions by linking management responses to specific aspects of climate vulnerability.

Climate vulnerability of Australia's threatened species

Climate vulnerability index values ranged from 11.275 for the most vulnerable species, the mountain pygmy possum *Burramys parvus* to -5 for the western quoll *Dasyurus geoffroii*; species where a value above 4.0 can be considered moderately vulnerable (Young *et al.* 2011). Mean climate vulnerability index was 3.6 and the degree of climate vulnerability varied significantly among taxonomic groups. Overall, amphibians were the most climate vulnerable group, followed by plants. Birds were on average the least vulnerable group.

Climate vulnerability showed a tendency to increase with the level of endangerment, with Vulnerable species being least climate vulnerable and Critically Endangered species being the most climate vulnerable. This suggests a biologically important, albeit weak tendency for climate vulnerability to increase with the level of endangerment of Australia's threatened species. This effect was consistent across all taxonomic groups except amphibians. Climate vulnerable species may be more susceptible to threats in general because of their physiological and life history traits, making them not just 'climate vulnerable', but 'threat vulnerable'. No relationship was found between population trend and climate vulnerability, suggesting that there is still enough time to implement management actions to help climate vulnerable species adapt.

There was marked spatial variation in climate vulnerability but no clear latitudinal gradient, suggesting that climate adaptation actions will be needed across the whole continent. Average climate vulnerability of species per subcatchment showed particularly high values through the western desert and eastern channel country / Eyre Basin, in coastal south-eastern Australia and in Tasmania.

In order to manage climate vulnerability it is important to understand the driving factors behind the vulnerability of a species. I therefore mapped the most predominant factor affecting species in each subcatchment. Threatened species across much of Australia are affected by multiple aspects of climate vulnerability (green colours, Figure 2), with no clearly predominant factor across large parts of northern WA, the Northern Territory and northern Queensland west of the Great Dividing Range. However, in southern Australia most areas had a clearly predominant factor that underpinned climate vulnerability. Low genetic variation (purple colours, Figure 2) influences species along the southern and south-eastern coasts of Australia. Reliance on specific disturbance regimes (red colours, Figure 2) predominates in western New South Wales and central South Australia. It is also important along the southern coast of Western Australia. Reliance on moisture (blue colours, Figure 2) is a predominant factor in patches across Australia.

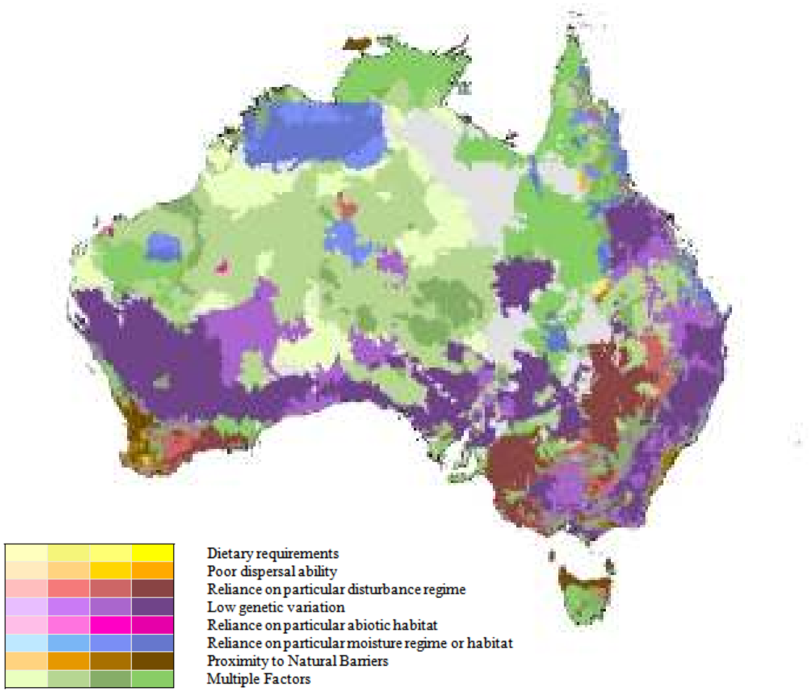

Figure 1: Predominant climate vulnerability factor affecting species in each subcatchment around Australia. Darker colours within each category indicate that a greater proportion of the species present in a subcatchment is affected by that particular factor. Grey represents areas where no species were assessed.

Protecting and Adapting Australia's Terrestrial Biodiversity

My analysis reveals multiple drivers of climate vulnerability in many regions, suggesting that multiple actions will be needed to achieve adaptation. However, climate change is an emerging threat, and there are few tried and tested adaptation options available. In the light of this, and to stimulate further work and a full prioritisation of climate adaptation actions, I suggest in my thesis a series of possible actions that could be taken.

Some actions such as habitat restoration are likely to benefit a great number of species and may be more feasible than actions targeted toward a single species, such as translocation. However to assist with some particular factors, more targeted actions may be required. Species unable to disperse properly because of natural barriers may require assisted-dispersal or restoration of a corridor. Other actions could include creation of microhabitats (Shoo *et al.* 2011), or supplementing habitats with PVC pipes or logs, controlling fire regimes through burns, building artificial water bodies or captively breeding species required as a food source (for eg. the Bogong moths *Agrotis infusa,* required by the mountain pygmy possum as a winter food source; Broome 2001)

In sum, climate adaptation actions vary markedly depending on the specific cause of climate vulnerability, which have a great deal of spatial variation. Therefore my discoveries on the spatial distribution of climate vulnerability factors are a critical foundation on which to build and prioritise adaptation options for Australia's threatened species.

References:

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