

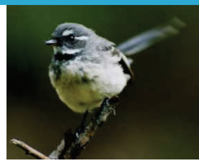

NCCARF
National Climate Change Adaptation Research Facility
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ADAPTATION CASE STUDY SERIES

Climate Change Adaptation Strategies for the Northern Bettong

by Dr Brooke Bateman

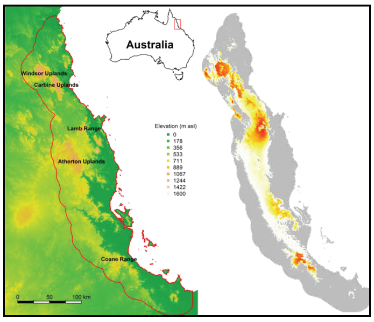
Study Summary

The northern bettong (*Bettongia tropica*) is a small, endangered rat-kangaroo that is endemic to the Wet Tropics of Queensland. Northern bettongs have a specialized diet of "truffles" - the fruiting bodies of subterranean ectomycorrhizal fungi, and their distribution is restricted to a strip of woodland on the western edge of the Great Dividing Range - where truffle productivity is high. Since European settlement, bettong distribution has contracted toward higher rainfall areas, due to factors including climatic changes, changed fire regimes, habitat clearance and grazing.

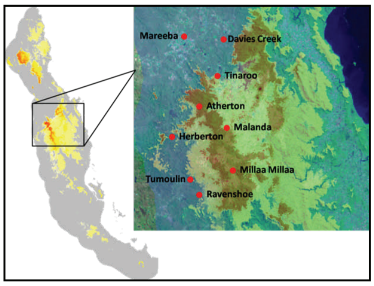
We investigated the altered distribution of the northern bettong, a competitor - the rufous bettong (*Aepyprymnus rufescens*) and the availability of food resources including truffles and cockatoo grass (*Alloteropsis semialata* - a dry season food). We assessed how climate (long-term average), weather (short-term average), and extreme events interact with the resource distribution of these animals. We also used species distribution models (Ozclim datasets, 0-6 °C warming at 0.5 °C increments) to predict how climate change could affect suitable climate space for the northern bettong and its biotic interactions (e.g. rufous bettong, truffles, and cockatoo grass).

Recent declines of the northern bettong at the southern edge of its distribution (Coane Range) are suggested to be caused by severe drought and variable weather, together with competition with the rufous bettong. Truffle availability was lower and inconsistent in this area - limited by rainfall, and dominant drought-tolerant truffles produced fewer fruiting bodies. Cockatoo grass was more suited to drier habitats, where competition from rufous bettongs is greater.

Climatic models indicate that the range of the northern bettong may further contract, with loss of climate space along the southern range edge. However, suitable habitat is predicted to persist in the core of the species range and on the northern range limits. While causes of recent population declines in the north are unclear, our results suggest that the species may be vulnerable to climate change and extreme weather events, particularly at its distributional range margins.



Modelled bettong climatic habitat now



Predicted future distribution based on a +6 C warming scenario.

Recommendations for Adaptation Management

Our study indicates that northern bettongs are vulnerable to projected climate change and extreme weather events such as drought. We therefore recommend the following adaptation strategies:

- Focus on maintaining resilience within the core species' range, where populations are abundant, and the climate space of the northern bettong is predicted to remain suitable given future projected climatic change.
- Focus management efforts on population assessment, and monitoring and drought mitigation in core areas.
- Prioritise protection on the key refugia predicted for the northern bettong on the Lamb Range and Atherton-Evelyn tablelands.
- Restoration of northern bettong habitat (wet and dry sclerophyll woodlands) that has undergone clearing and is degraded.
- Establish habitat continuity between patches of suitable habitat, both existing suitable habitat and areas of future potential habitat, with possible additional habitat and restoration efforts.
- Implement resource management for northern bettong during drought, such as promotion of truffle fruiting, revegetation of cockatoo grass, etc.
- Focus research on key aspects of the northern bettong ecology, for which there is insufficient current knowledge, specifically:
    - Understanding and monitoring the dynamic interaction between northern and rufous bettongs.
    - Understanding the factors determining the northern range edge for the northern bettong, why abundance is low, and why populations have declined along this range edge.
    - Understanding the role of altered fire regimes, and subsequent vegetation change on northern bettong resources and habitat.
    - Management actions for cockatoo grass, including reduction in litter-layer cover and competing grass species.

Research Overview

The aim of this study was to identify climate and weather variables that are important for the sustainability of populations of the northern bettong and its key food resources, both under present and future climates. We used a combination of different modelling techniques and field studies to conduct this research.

Pressure from severe weather events, in combination with other pressures such as competition, predation and anthropogenic factors within its already limited range may make this species particularly susceptible to climate change. In addition, the relatively stable current core of the species range is likely to see shifts in suitable climate space in a region that has undergone large amounts of human-induced habitat alteration, which may limit the ability of the species to track suitable climate space in the future. The results from our study may be used to inform proactive conservation actions and inform management decisions for the northern bettong and its food resources in the face of climate change.

Results and Conclusions

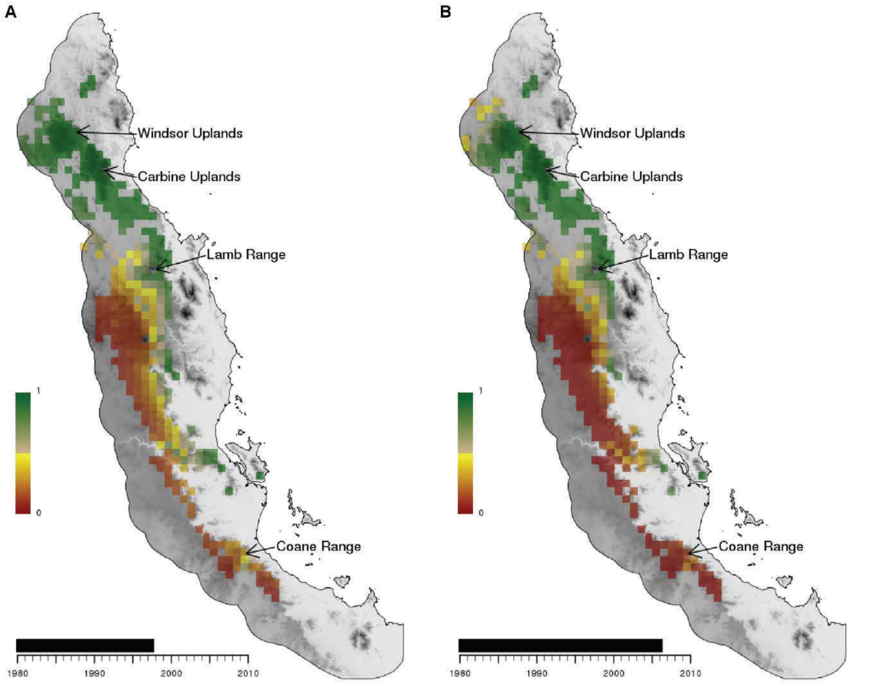
Recent droughts have been implicated as the prominent cause of lowered population densities and local extinctions of northern bettong populations at the southern edge of their range. As the availability of the northern bettongs main food resource (truffles) is dependent on rainfall, reduced truffle availability within the range edges was attributed to more variable weather conditions and severe drought compared to the core range. Cockatoo grass appears to persist in drier conditions, although some management options may be needed to maintain this alternate food resource. Rufous bettongs are shown to overlap areas of suitable habitat with northern bettongs during times of stressful weather conditions (e.g. droughts), and may compete during times of low truffle availability (e.g. low rainfall). In addition, with increasing temperatures (between +3 and +6 °C) as a result of climate change, there will be a loss of suitable climate space within the southern range limits of the northern bettong. Within the core of the species distribution on the Lamb Range climate models indicate that there will be a shift in suitable climate space towards the west and south, and an increase in suitable climate space in the north-west uplands. Persistence of suitable climate space in the northern range limits is promising, but the recent failure to detect the northern bettong in this region is of concern. When the availability of food resources (cockatoo grass and truffles) was included in predictions of suitable climate space for the northern bettong, the model was improved, and future suitable habitat of the northern bettong with climate change will likely be dependent on conditions for these resources.

Models of suitable weather for the northern (green) and rufous (red) bettong.

The niche overlap zone, area where these two sets of conditions overlap, and therefore where there is likely to be strong competition between the two bettong species is identified by yellow-tan.

a) Suitable conditions for October 1997; when northern bettongs were present and rufous bettongs were absent in the southern margin.

b) Suitable conditions for May 2006; when northern bettongs were absent and rufous bettongs were present in the southern margin. (from Bateman *et al.* 2012).



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Read more about this research:

Bateman, BL, Abell-Davis, SE and Johnson, CN. (2012) Climate-driven variation in food availability between the core and range edge of the endangered northern bettong (*Bettongia tropica*). *Australian Journal of Zoology*, 59 (3), 177-185.

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