Weeds in a warmer climate: a tool for assessing tolerance to changing temperatures

Rachael V. Gallagher[1], Linda Beaumont[1], Paul O. Downey[2], Lesley Hughes[1] and Michelle R. Leishman[1]
[1] Department of Biological Sciences, Macquarie University, North Ryde, New South Wales 2109, Australia
[2] Pest Management Unit, Parks and Wildlife Division, Department of Environment and Climate Change (NSW), PO Box 1967, Hurstville, New South Wales 2220, Australia.
Email: rgallagher@bio.mq.edu.au

Summary As global temperatures continue to rise it is important to identify *a priori* invasive species that will benefit most from global warming. While various approaches exist for assessing species' responses to climate change, we propose a rapid assessment tool that provides a first approximation of the intrinsic ability of a species to tolerate warmer temperatures. Invasive species may occupy different climatic niches in their non-indigenous range compared with their native range (Broennimann *et al*. 2007), and comparisons of temperature across these ranges may help us to identify species responses to global warming. Three scenarios may occur: 1) average maximum temperature of the exotic distribution is the same as the native distribution, 2) average maximum temperature in the exotic distribution is greater than the native distribution, due to factors such as different biotic interactions or niche displacement, 3) average maximum temperature in the exotic distribution is less than in the native distribution. Without modelling or experiments we cannot readily predict the response of species in categories 1 or 2. In contrast we can hypothesise that species in category 3, occupying exotic ranges where temperatures are cooler than their native range, are well positioned to capitalise on increases in global temperature (Vilà *et al*. 2006). These species would be pre-adapted to tolerate warmer temperatures and therefore may be better equipped to endure increases in both mean temperatures and extreme heat events than co-occurring native species. This tolerance may confer a competitive advantage to exotics, promoting their dominance in native communities under warmer climates.

METHOD

Distributional data from the native and exotic ranges of plants invasive to Australia is available from online databases and the published literature. These distributions can be mapped in a Geographic Information System and overlaid with data on mean annual temperature, maximum temperature of the hottest month and minimum temperature of the coldest month. Comparisons between the temperature range in the native and exotic distributions can then be compared using simple graphs, enabling species to be placed into one of the above three categories. Additional information on time since colonisation and ecotype of the original native population could be added to the assessment when available.

CONCLUSIONS

This rapid assessment tool can be used to investigate the degree of similarity in mean annual temperatures and temperature seasonality between the exotic and native ranges of naturalised or invasive species. This framework may guide the application of other more time-intensive techniques, such as species distribution modelling, to assess invasive species' responses to climate change.

REFERENCES

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