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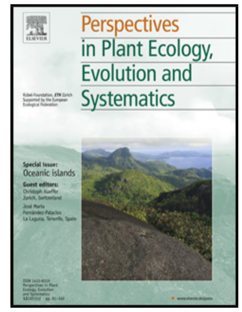

Title: A Mechanistic Model of Climate Change Risk: Growth Rates and Microhabitat Specificity for Conservation Priority Woodland Epiphytes

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A Mechanistic Model of Climate Change Risk: Growth Rates and Microhabitat Specificity for Conservation Priority Woodland Epiphytes

Short Title: Epiphyte Climate Change Risk

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Highlights

- The development of a mechanistic model for climate change risk, focussing on epiphytes as a model system (cyanolichen and tripartite species).
- The model is based on variation in habitat use and generation times along spatial climatic gradients.
- These variables are used to parameterise a population simulation, verified against ecological field data.
- The simulation explores the consequences of climate change (via slower growth rates) and demonstrates the scale of management solutions (increased habitat availability).

ABSTRACT

Climate change studies need to develop models for species risk that are mechanistic and predictive, with conservation strategies explored through the use of scenarios. This study focused on a diverse group for climate change analysis – lichen epiphytes – to develop a heuristic model for quantifying risk that has two key components. First, it draws on the classic ecological concept – '*das Gesetz der relativen Standortskonstanz*' – which explains how the suitable niche space of a species (at a microhabitat-scale) may occur under different local circumstances in contrasting macroclimatic zones. To quantify this pattern, conservation priority cyanolichen and tripartite epiphytes were sampled across a steep climatic gradient, to characterise their different microhabitat preferences in optimal and sub-optimal macroclimates. Second, the model used climatically controlled growth rates as a functional response to climate variability, leading to an increase in generation time for sub-optimal climates. Together, the macroclimate-microhabitat and growth rate data parameterise a mechanistic population model that was used to explore the effect of environmental change scenarios, including: 1. Climate change leading to longer generation times, and 2. A reduction in