Using restoration records to assess resilience of jarrah forest to climate change

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Background/question/methods: There is an urgent need to understand the potential effects of future climate change on biodiversity and what interventions might be necessary to mitigate species loss. The biodiversity hotspot of south-western Australia has already experienced significant climate change—a 14% reduction in mean annual rainfall over the period 1975 to 2004 compared with mean rainfall from the mid-1900s to 1974. Long-term records of jarrah-forest restoration following bauxite mining have been collected by staff at Alcoa of Australia for the last 20-years of the observed rainfall decline in south-western Australia. Records include annual data on seeding rates and seedling establishment for over 550 species. These records offer an unprecedented opportunity to test for climate-based 'assembly rules' for ecosystem restoration by relating historical rainfall amounts and timing to patterns of vegetation development.

Results/conclusions: Rainfall amounts undoubtedly help determine patterns of seedling establishment in Mediterranean-climate ecosystems such as the jarrah forest, yet there is uncertainty about the response of individual species to the incremental decline in rainfall (i.e., threshold effects) and how these might sum to affect the resilience of the jarrah forest to ongoing climate change. We built a structural equation model to discriminate the relative effects of climate, restoration protocol, plant traits and their interactive effects on the similarity of plant assemblages. Our model was informed by decades of research on the restoration of jarrah forest after bauxite mining. We describe the model and its implications for understanding current and predicting future impacts of climate change on forest ecosystems.

Rachel Standish is a Plant Ecologist at the University of Western Australia. She has recently joined the Environmental Decisions Group, and this research will be a contribution to this group's efforts to determine if resilience and related concepts can inform ecosystem management.

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