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Restoring natural riparian vegetation systems along the Warren and Donnelly Rivers

Ecosystem Science

Project Core Team

Supervising Scientist	Margaret Byrne
Data Custodian	
Site Custodian	

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M Byrne, T Hopley, T Macfarlane, C Ramalho, C Yates

Context

Current practices of seed sourcing for revegetation projects focus on local seed, based on a premise of maximising adaptation to local conditions, but this may not be most appropriate under changing climatic conditions. Identification of patterns of adaptive variation will enable more informed approaches to species selection and seed sourcing to maximise establishment and persistence of plants in revegetation programs.

This project will provide a climate change framework for revegetation of blackberry-decline sites on the Warren and Donnelly Rivers by determining the scale of adaptation to climate along the river system and determining the best seed source strategies to maximise resilience to future changes in climate in the revegetated populations.

Aims

- Develop a climate change framework for revegetation of riparian vegetation along the Warren and Donnelly Rivers.
- Determine seed sourcing strategies that account for climate adaptation to enable resilient restoration of riparian vegetation along the Warren River and Donnelly Rivers.
- Test adaptation to climate through experimental plantings under operational conditions of establishment.

Progress

- Analysis of genomic data has found the three species (*Astartea leptophylla, Callistachys lanceolata, Taxandria linearifolia*) to have different patterns of genetic structure across the climate gradient. *Astartea leptophylla* is restricted to the main river and was found to have the lowest levels of differentiation between populations. *Callistachys lanceolata*, a widespread species with short distance dispersal had high levels of genetic structure between populations. This data will be used to determine genetic adaptation between populations and climate zones of the three species.
- Initial outlier analysis has found the *Astartea* to have low numbers of outliers (97) and the majority are under directional selection.
- *Callistachys* was found to have a similar number of outliers (96) but two-thirds of these are under balancing selection.
- *Taxandria* with moderate levels of genetic diversity between populations was found to have high numbers of outliers (264) with three-quarters of these under directional selection.
- Experimental plantings were impacted by insect damage and have been replanted this year with insect exclusion measures in place.
- A manuscript detailing a spatially explicit approach to support decision making for seed provenance selection in ecological restoration in a climate change context has been revised and submitted for publication.

Management implications

Changing climates require a re-evaluation of appropriate seed sourcing strategies for revegetation and restoration of ecological function in degraded sites. Use of local seed will not provide adequate resilience to maintain ecological function under changing climates, and understanding of climate adaptation will provide a scientific basis to undertake best-practice restoration and facilitate establishment of biodiverse plantings that maximise ecological function for enhanced persistence and resilience. Development of a strategic revegetation program for the riparian areas of the Warren and Donnelly catchments will provide an integrated approach to habitat restoration that promotes improved plant community function and improves the knowledge and capacity of restoration practitioners and land managers.

Future directions

- Complete analysis of association between allele frequencies of outlier loci and ecological variables to identify potential adaptive loci.
- Identify genetic markers subject to selection and associated with population-specific climate variables to reveal specific significant climatic associations and how these are related to genetic structure and gene flow.
- Sample from experimental plantings of *Callistachys* for genomic analysis to assess establishment and performance and to determine any effects of adaptation to drier environments on current performance of germplasm in revegetation projects.
- Identify the scale of climate associations and the implications of these for seed sourcing with the aim of maximising resilience in restoration projects.
- Prepare manuscripts on genetic structure and outlier identification for all three species .