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MULTIDIMENSIONAL ADAPTATION

SIGNATURES OF NATURAL SELECTION IN A FOUNDATION TREE ALONG MEDITERRANEAN CLIMATIC GRADIENTS

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CONTEXT AND MISSION

Rapidly changing temperature and precipitation patterns are causing significant forest decline, particularly in Mediterranean climates.

Forest management strategies encompassing adaptation to changing climates in heterogeneous landscapes is critical to ensure future forest resilience.

We investigated whether local adaptation in a widespread tree in a Mediterranean climate is associated with climate variables of precipitation and temperature.

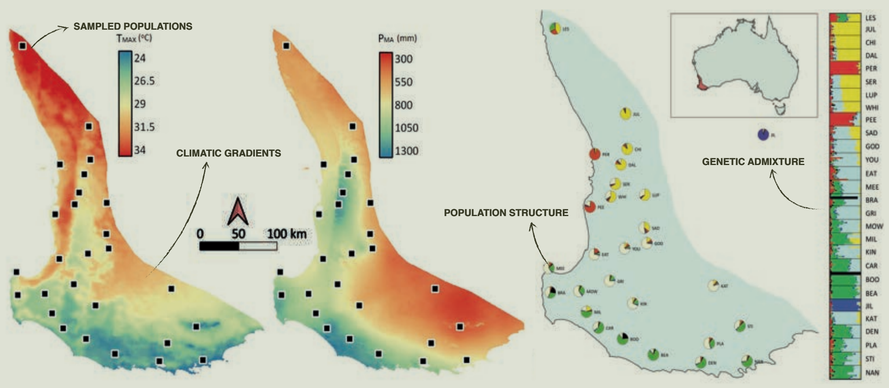
RESEARCH QUESTIONS

Are the patterns of local adaptation associated with climate?

Which climatic variables are more important for adaptation?

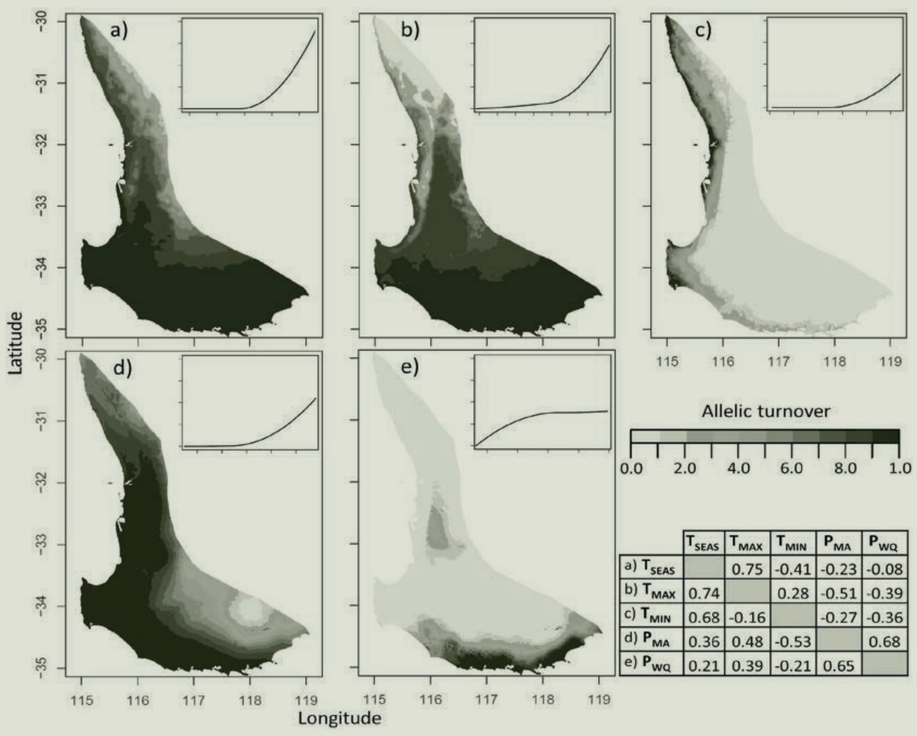
Do related biological processes show similar patterns of adaption across the landscape?

KEY RESULTS



LOW POPULATION DIFFERENTIATION (F_{ST}=0.04) I SIX CLUSTERS GEOGRAPHICALLY DESCRIBED.

THE PATTERNS OF GENOMIC TURNOVER ASSOCIATED WITH THE CLIMATIC VARIABLES ARE ALIGNED WITH THE CLIMATIC GRADIENTS OF THE REGION



	T_{SEAS}	T_{MAX}	T_{MIN}	P_{MA}	P_{WQ}
a) T_{SEAS}		0.75	-0.41	-0.23	-0.08
b) T_{MAX}	0.74		0.28	-0.51	-0.39
c) T_{MIN}	0.68	-0.16		-0.27	-0.36
d) P_{MA}	0.36	0.48	-0.53		0.68
e) P_{WQ}	0.21	0.39	-0.21	0.65	

Rapid turnover for the three temperature variables from the coastal to eastern populations in the north of the range. Gradual turnover from the northern populations to the southern populations (a, b, c).

In contrast, the precipitation variables showed rapid turnover in the southern or central parts of the distribution, and more gradual turnover in the northern distribution (d, e).

These associations are indicative of multidimensional patterns for adaptation resulting in different responses to temperature and precipitation variables.

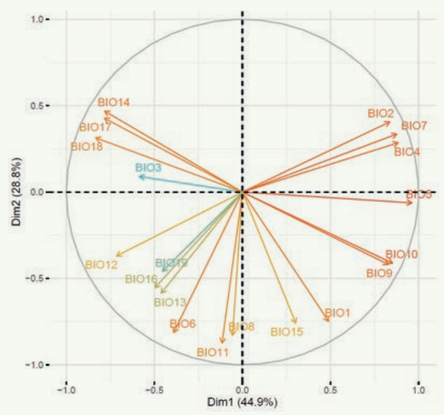
Complex interactions indicate that management of tree populations will require selection of adaptive variation across climate variables.

BEHIND THE SCENES

1. SAMPLING AND SEQUENCING

28 Populations
DArTseq 78,198 SNPs
Filtered 13,534 independent SNPs

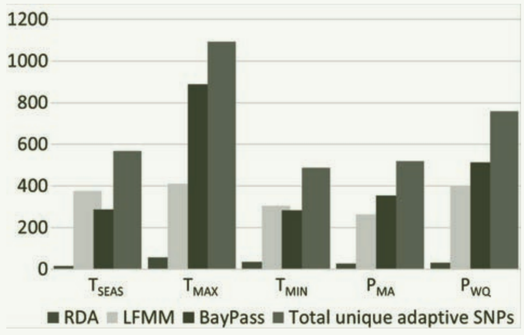
2. PCA OF CLIMATE VARIABLES



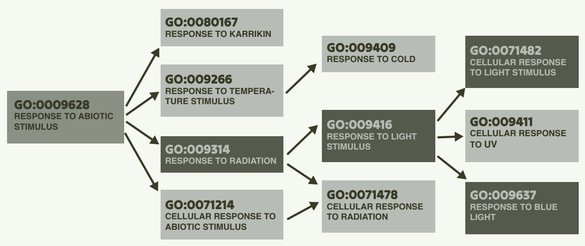
3. SELECTED CLIMATE VARIABLES

BIO4	T_{SEAS}	Temperature Seasonality
BIO5	T_{MAX}	Max Temperature of Warmest Month
BIO6	T_{MIN}	Min Temperature of Coldest Month
BIO12	P_{MA}	Annual Precipation
BIO18	P_{WQ}	Precipitation of Warmest Quarter

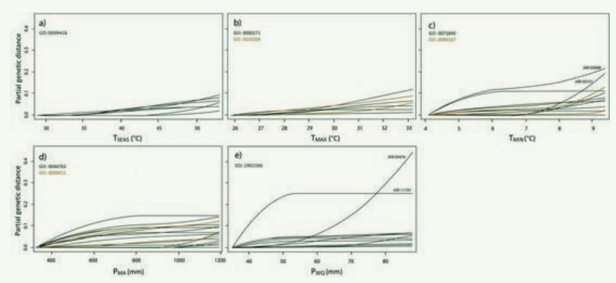
4. GENOME-ENVIRONMENT ASSOCIATIONS



5. ANNOTATION AND GENE-ONTOLOGY



6. GENERALIZED DISSIMILARITY MODELLING



JARRAH

Eucalyptus marginata

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