TARGETED ECOLOGICAL AND GENETIC RESEARCH

FOR ENHANCING TRANSLOCATION OF RARE SPECIES IN URBAN AREAS

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Recent and forecasted increases in flight traffic at Perth Airport have necessitated the construction of a new runway which is proposed to be located on the eastern side of the Perth Airport estate, and currently planned for construction between 2025-28. The construction of this new runway will require clearing of up to 129 hectares of native vegetation which will subsequently impact populations of two threatened flora species: Conospermum undulatum and Macarthuria keigheryi. This project includes a comprehensive Monitoring, Research and Propagation Plan for the two plant species, aimed at establishing new viable populations at translocation sites by improving propagation success through various seed and cutting experiments, which is crucial given the limited seed availability.

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Conospermum undulatum flowers with Leioproctus conospermi, a highly specialised Conospermum pollinator.

Macarthuria keigheryi flowers.

Eddie van Etten with a Conospermum undulatum.

SEED GERMINATION

Due to the poor seed set and viability, and low germination rates noted for *C. undulatum* across different populations, future efforts to research, propagate, restore or translocate this species will require the improvement of current germination protocols. Initial germination trials in lab conditions found no physical dormancy, and treatment with gibberellic acid increased germination rates from 11 to 27%, which indicates physiological-imposed dormancy; while fresh seeds were not responsive to smoke treatment, smoke cues increased germination rates after-ripening age.

Conospermum undulatum seeds

Conospermum undulatum seedlings

VEGETATIVE PROPAGATION

As a non-obligate seeder, *C. undulatum* has the potential for ex-situ vegetative propagation through stems and roots. Cutting material (soft, semi-hard and hardwood cuttings) has been collected and placed in cutting mix after rooting hormone (IBA) gel application.

Collection of plant cutting material

Cuttings placed in cutting mix after IBA application to promote rooting

THE TEAM

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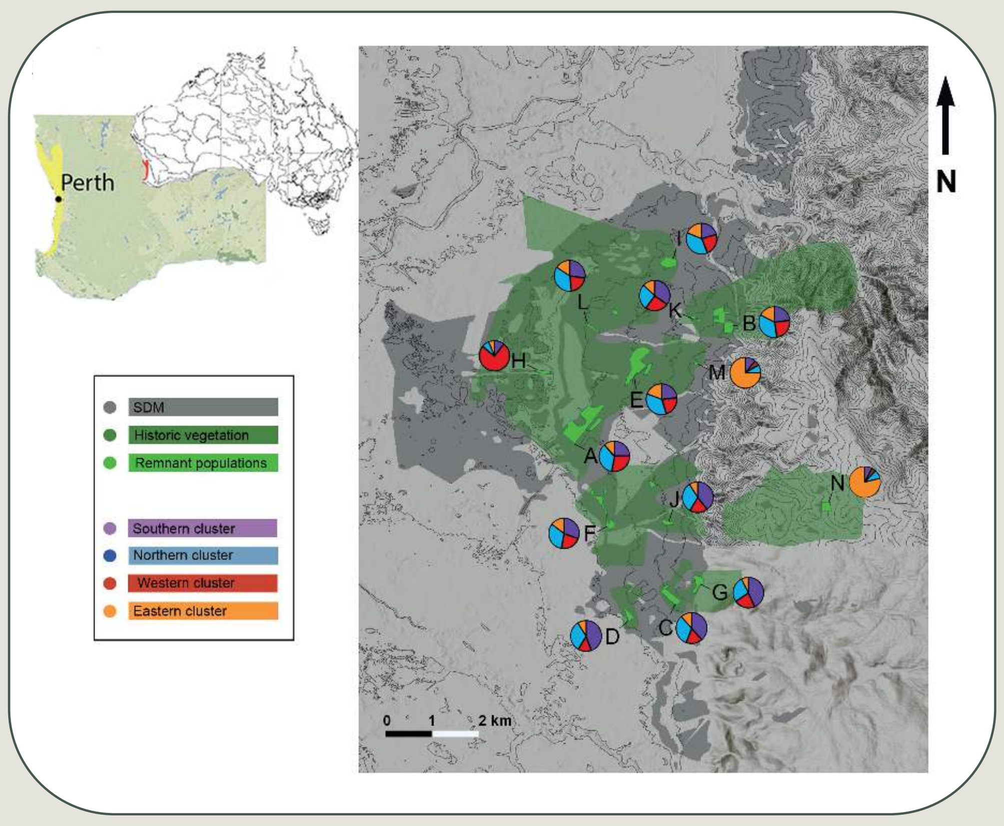
POPULATION GENETICS AND CONNECTIVITY

Detailed genetic profiling of source populations is conducted to select appropriate genotypes for translocation, and genetic profiling of established plants is performed to determine which genotypes should thrive at translocated sites versus those that might easily perish. This approach also tests the benefits of genotypic selection, addressing concerns from recent studies indicating that translocated populations can be dominated by a limited range of genotypes.

Species distribution model for Conospermum undulatum (SDM; darker grey) superimposed on a shaded relief map with 10 m altitude contour lines. Bright green represents current extent of native bushland containing C. undulatum. Pie charts show the assignment probability of each population to genetic clusters inferred at K = 4 in Bayesian clustering using STRUCTURE analysis of microsatellite markers.

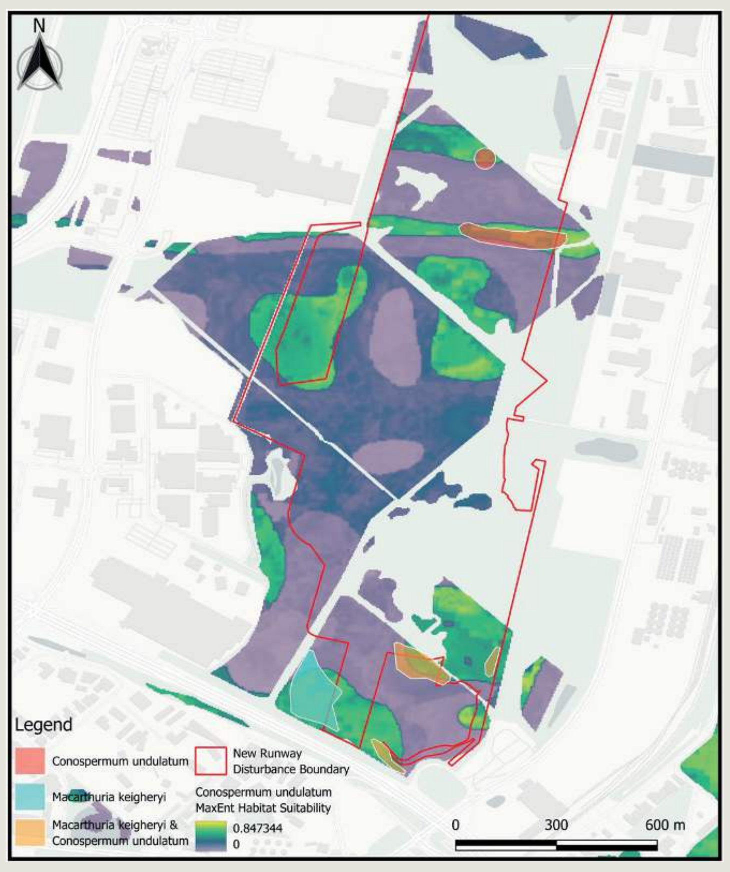


Typical Banksia woodland habitat of Conospermum undulatum during flowering season.

SUITABLE HABITAT

A significant aspect that emerged from recent work on *C. undulatum* is the importance of maintaining high population floral displays to avoid creating small patches not attractive to pollinators due to a lack of resources. Moreover, small and isolated remnant populations are more likely to have restricted availability of genetically unrelated mates, leading to a further reduction of the reproductive output through viable seeds. Maintaining suitable habitat that allows a consistent inter-population pollen flow, therefore, appears crucial for small populations where the natural seed set is too low to ensure long-term population persistence.

Geophysical surveys (GPR and ERT) outline the subsurface features of each population cluster and potential translocation sites to determine if there are certain subsurface characteristics favoured by the target plant species, such as minimum distance to underground water table.

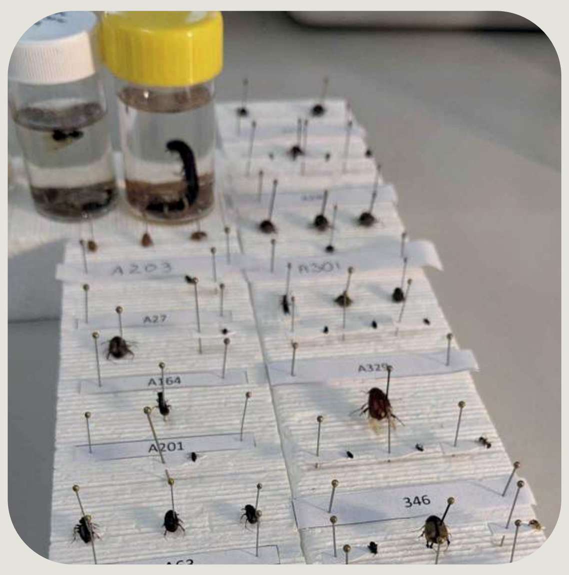


The habitat suitability of Conospermum undulatum at the Perth Airport estate based on a variety of predictor variables: soil type, vegetation complex and depth to ground water, on a 5m spatial scale.

SOIL SEEDBANK AND INVERTEBRATES

The soil seedbank is essential for plant ecology, serving as a reservoir of seeds that can remain dormant until conditions are favorable for germination. Investigating soil invertebrate biodiversity is key to understanding seedbank dynamics, as organisms like ants, beetles, and worms affect seed dispersal, predation, and decomposition. By comparing the invertebrate communities in the native habitat of a target plant species with potential translocation sites, we can evaluate the ecological suitability of new areas. Matching invertebrate biodiversity ensures that important interactions, such as seed dispersal, will support the survival and establishment of translocated plants.

Topsoil collections to investigate the soil seedbank;



C. undulatum seed and invertebrates sampled from topsoil