Progress Report SP 2018-068

Conservation genetics

Kings Park Science

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Project Team	granted
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Conservation genetics

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Context

The conservation and restoration of Western Australia's unique biodiversity is underpinned by genetics research that aims to understand the ecological requirements of native flora and their genetic vulnerabilities to threats, including mining activities. Such research provides information on genetic diversity, population and species relationships, mating system and pollen dispersal to support restoration, conservation, population management and taxonomy.

Aims

- Experimentally assess seed sourcing strategies for improved restoration outcomes.
- Assess the conservation and evolutionary consequences for plants pollinated by vertebrates.
- Assess reproductive functionality in restored plant communities.
- Experimentally assess the resilience of plant populations to environmental stressors.
- Assess responses of soil biota through ecological restoration.

Progress

- Seed sourcing strategies for ecological restoration under current and future climates were assessed for *Banksia menziesii, B. attenuata* and *Eucalyptus todtiana* through large-scale field-based provenance trials across the Swan Coastal Plain. Initial results suggest no advantage from climate adjusted provenancing.
- The restoration consequences of mixing seed source provenances was experimentally assessed for *Stylidium hispidum* in the northern jarrah forest. Life time reproductive output showed local inbreeding depression and outbreeding depression at a landscape scale, with an optimum at ca 10km.
- The consequences of nectar-feeding birds as pollinators for eucalypts, banksias, kangaroo paws and catspaws continues to be assessed. Results show that while bird pollination typically causes high multiple paternity and wide outcrossing, this is impacted by the ecological properties of the local population. Some species assessed showed highly specialised relationship with bird pollinators, such that introduced honeybees can have significant consequences for plant reproduction.
- Connectivity among old fragmented and newly restored populations of *Banksia menziesii* was demonstrated, showing that highly mobile bird pollinators move freely into restored banksia populations.
- Results from reciprocal transplant experiments and stress-related gene expression analysis of seagrass in Shark Bay suggests adaptation and a resilience to climate change.
- The diversity and composition of soil microbial communities following post-impact rehabilitation in the Jarrah forest were assessed using eDNA. Although restored soil biota communities are returning towards the pre-disturbance state, even after 30-years key elements are still missing.

Management implications

- Seed sourcing guidelines developed for the Swan Coastal Plain improve restoration outcomes through the genetic delineation of locally adapted provenance zones for multiple species.
- Effectiveness of in situ and ex situ management can be improved through manipulating spatial genetic structure to maximise outcrossing and avoid genetic effects associated with inbreeding.
- Clarity on the significance of birds and introduced honeybees for pollination of Banksia woodlands of the Swan Coastal Plain, a threatened ecological community.
- Improved guidance on restoration criteria through enhanced knowledge of soil biota.

Future directions

- Continue to assess conservation genetic consequences of vertebrate pollination through molecular and ecological studies.
- Continue to assess the resilience of seagrass to environmental stressors through reciprocal transplant trials in Shark Bay, population genomic analysis, and controlled manipulative experiments.
- Continue to assess seed sourcing for restoration strategies through large scale provenance trials, glasshouse trials, and seed germination trials for *Banksia menziesii*, *B. attenuata* and *Eucalyptus todtiana*, which are key species for ecological restoration on the Swan Coastal Plain.
- Assess delivery of vertebrate pollinator services as a measure of restoration success for *Lambertia multiflora* in ecologically restored plant communities.
- Assess the impact of introduced honeybees (*Apis mellifera*) on native flora and fauna.
- Assess the post-disturbance restoration of soil biota using eDNA, and above-ground/below-ground linkages.