Experimental translocation of the threatened banded ironstone wedding bush in Western Australia

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Introduction

Ricinocarpos brevis R.J.F.Hend. & Mollemans (Euphorbiaceae) is declared as 'Rare Flora' under the Biodiversity Conservation Act 2016 (WA) in 2005, and listed as Endangered under the Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth). It is currently ranked as Critically Endangered (CR) under World Conservation Union (IUCN, 2001) Red List criteria B1ab and 2ab (based on severely fragmented populations and continued decline in, extent of occurrence and area of occupancy). Project location is in the Eastern Goldfields region, north of the Southern Cross town-site, in Western Australia. The species is a short range (~100 km) endemic recorded from just three locations. It occurs on the mid to upper debris slopes of rocky ironstone and weathered basalt ridges. These ridges are rich in minerals and the main threats to the species are mining and exploration activities (DEC, 2016).

The species is a non-lignotuberous, monoecious shrub growing up to 1.8 m in height, with evidence of flowers being insect-pollinated and seeds being ant-dispersed (DEC, 2016). Recruitment is likely to be episodic pulse-events, with soil moisture availability the principal driver of seedling emergence, in this semi-arid environment with ~300 mm annual rainfall (Elliott, 2019; Turner, 2018).

Ricinocarpos brevis male flower © Carole Elliott

Goals

- To improve the understanding of methods to translocate *Ricinocarpos brevis*.
- Assist in establishing *R. brevis* populations on waste rock landforms and/or other areas disturbed by mining.

Ricinocarpos brevis habitat © Carole Elliott

Success Indicators

- Success of the translocation is defined where 10% or more of the translocated individuals remain alive two years following translocation.
- Translocations are expected to provide information of value in the context of determining appropriate methodologies for the establishment of *R. brevis*.

Project Summary

Feasibility:

Habitat: Waste rock landforms were prepared to a mining standard that requires landform stability (i.e. erosion control) and a restoration standard that includes ripping to alleviate compaction, application of topsoil and surface sown seeds of local native species. Soil profiles are incomplete, often with a base profile of mixed large, small and fine scale waste rock fractions, which provide durable substrates for achieving landform stability; and a surface cover of topsoil that is ideally applied to a depth of <10 cm, whilst maintaining favourable soil-moisture properties for plant establishment.

Species: "*Ricinocarpos brevis* is an upright shrub 1 - 1.8 m in height and 1 - 1.5 m in width. The leaves are obovate, 10 to 25 mm long and 4 to 6 mm wide with strongly recurved margins and stellate hairs on both surfaces. Flowering generally occurs during the cooler months but may flower following large out of season rainfall events. Fragrant white flowers have been recorded from March to July, with the species having separate male and female flowers on the one plant (monoecious). Fruits contain up to three seeds (one ovule per ovary segment) and develop during spring, expand to around 12 mm in length and dehisce explosively in October/November." (DEC, 2016).

Socio-political and economic issues: "Mineral exploration leases cover the areas where *Ricinocarpos brevis* is known to occur. The occurrences of *R. brevis* has

Experimental translocation site © Carole Elliott

caused, and has the potential to cause, negative economic impacts through compliance with the environmental impact assessment and approvals process, and the potential restriction of future access to underlying iron ore deposits. There is also potential for translocation sites to complicate future access to mineral resources." (DEC, 2016).

Note: Text in quotation ("…") is quoted directly from the species Interim Recovery Plan, issued by the Department of Environment and Conservation (DEC, 2016).

Implementation:

Translocation:

Recipient sites (disturbed, waste rock landform) for experimental translocations were selected based on:

- Being close to natural populations (i.e. landscape connectivity).
- Land tenure and risk of future mining activity.
- Safe and ongoing accessibility to sites located within mining activities.
- Landscape aspect (e.g. preference for southern facing aspect).
- Rehabilitation stage of waste rock landform (i.e. capacity to install translocation).
- Physical and chemical assessment of soils (i.e. similar to natural population).
- Capacity to install infrastructure (e.g. irrigation).

Experimental translocations were installed yearly in April - June in 2013 - 2017, and designed to compare the success of tubestock planting and direct seeding. Tubestock experiments used 24 plants per treatment and tested up to five treatments in each translocation year. Treatments investigated to determine tubestock survival included shading, fertiliser, irrigation, propagation source (seed or cuttings), plant age, water holding crystals and biodegradable pots. Direct seeding experiments, used eight replicates of 25 seed for each treatment and tested up to six treatments each year. Treatments that were investigated included aspect (north or south-facing), shade, irrigation, seed burial, seed enhancement (priming or pelleting) and water holding crystals. Each replicate (tubestock or seed) was individually fenced to protect against herbivory.

Cultural/tribal: "A search of the Department of Indigenous Affairs Aboriginal Heritage Sites Register has identified four sites of Aboriginal significance within the vicinity of the populations of *Ricinocarpos brevis* on the Windarling Range (DIA, 2010). Liaison has been included as a recovery action to ensure there will be Indigenous engagement in relation to the recovery actions posed in this plan." (DEC, 2016).

Phytosanitary concerns: Translocated tubestock were propagated and grown in an accredited nursery (Kings Park and Botanic Garden Nursery) prior to planting in translocation sites, thereby posing no inherent phytosanitary risks.

Post-planting monitoring:

Monitoring: Intensive monitoring of tubestock and direct seeding was conducted regularly after installation: at 1 - 2 months (late autumn); 4 - 5 months (spring); 7 - 8 months (early summer); 9 - 10 months (late summer) and 12 months (early autumn) for every year of the translocation program. Monitoring involved quantification of seedling emergence, survival, growth, health, and reproduction.

Results: Evaluation showed that shading, irrigation and older tubestock increased seedling emergence, survival, plant health and growth. However, the magnitude of these increases depended on seasonal rainfall, as these approaches were more effective in average or above average rainfall years. For example, overall seedling emergence (autumn to spring) for 2015 was lower (1.7%) than 2016 (4.5%), despite experimental irrigation, and was most likely affected by reduced rainfall over this period (2015 was 54% below average and 2016 was 13% below average).

Major difficulties faced

- Poor knowledge of plant establishment into waste rock landforms.
- Challenge of installation of irrigation systems on engineered waste rock landforms.
- Increasing frequency/severity of drier winters (climate change).
- Unknown horticultural capacity of species and how to transfer them to natural environments..

Major lessons learned

- Knowledge of population genetic structure is important for making informed decisions on sourcing material.
- Establishment on waste rock landforms is possible, with greater survival of tubestock derived from seed rather than cuttings.
- Older tubestock (8 - 18 months) establish better than younger tubestock (<6 months) due to reduced impact on root systems during planting.
- Shading and irrigation improved establishment, growth and survival of tubestock and seedlings.
- Soil moisture is the primary driver of seedling emergence, establishment

and plant survival.

Success of project

Highly Successful	Successful	Partially Successful	Failure
	[highlighted]		

Reason(s) for success:

- Three of the five translocations resulted in >10% survival after two years.
- Information gained from these experimental translocations guided the development of appropriate methods for translocation of the species (Elliott, 2018).
- Investment in research provided critical information for successful plant establishment and an experimental framework that identified and refined the best approach for future translocations.

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