

## Evaluating native Pilbara plants for alternative seed-use supplies whilst providing ecosystem support and meeting mine rehabilitation targets

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### Abstract

A scoping study was conducted to identify and examine properties of native plants from the Pilbara that may be pursued to meet mine rehabilitation targets, whilst providing additional benefits such as for human use, animal fodder and/or the provision of beneficial ecosystem services. Of the 125 plant species assessed, the majority of plants had value across a broad range of attributes. There were 54 species that had documented uses as human food, and 36 species that had information on medicinal uses. At least one third of the plant species had some form of reported other human uses, such as for fuel, timber and resin. The study also exposed candidate species that could be grown to provide feed for livestock (n=33), offer additional agricultural values (n=25), or ecological benefits (n=57). This study revealed that there was opportunity to explore native plants for use as bushfood, novel medicines, crops, pasture/fodder and other products whilst still using these species in mine rehabilitation programs. Success of using and progressing these candidate species in the future is likely to be limited by their seed biology, seed cost and supply, as well as some other factors. Therefore, a coordinated effort to secure viable seed supplies and understand their plant establishment needs is still required. With this, it is important to establish site-specific rehabilitation approaches that are fit-for-purpose, and that will work towards the concept of using these species within a wider regional landscape, industry and regional planning initiatives.

**Keywords:** Pilbara, native plants, seed use, mine rehabilitation

### Introduction

The Pilbara region in north-west Western Australia is a significant contributor to the national economy, with rich natural resources and strong mining and agricultural industries. When mining ceases, land which has been mined needs to undergo rehabilitation-revegetation, but there is a significant challenge to determine which plants are appropriate for this to meet the agreed outcomes. In current practice, native species used for revegetation in the Pilbara are selected based on their presence in the area prior to disturbance, as well as availability of seed that are sourced from wild populations. Apart from the mining sector, demands for native seeds for the farming sector and other restoration efforts are also significant. This comes with many challenges - apart from limited seed availability and quality, these plants often have complex requirements for seed germination and plant establishment (Erickson *et al.* 2017).

Consequently, only a modest range of plants are commonly used in rehabilitation. It is now well recognised that rehabilitation approaches based solely on species taxonomy, seed availability or ease of propagation are of limited value (Ilunga wa Ilunga *et al.* 2015). There is evidence that native plants may provide other opportunities beyond simple revegetation. They provide ecosystem support, services and provisions for wildlife, but can also be turned into food, medicine, used as forage or for materials and have many other secondary purposes (Ecoscape *et al.* 2018). However, information on other attributes of potential value is lacking or poorly synthesised.

The aim of this study was to examine a range of native plants found in Pilbara for their potential to provide a sustainable supply of seed for rehabilitation, as well as for bushfood, pastoral, and bio-materials business ventures, and to explore some concepts and scenarios that can be used for post-mining land rehabilitation. The information presented in this report is intended for guidance in the further development of options that are deemed likely to support the future establishment of seed and/or plant production fields at mining operations in the Pilbara.

## Methods

A targeted review was carried out to summarise available information about relevant plant species, focussing on a range of plant attributes that are suitable for use in mine site rehabilitation in Pilbara. The evaluation included data drawn from scientific literature, various other reports, publications and databases, as well as input and opinions from project members. The process first involved creating a targeted species list through filtering down from a broad representation of available flora in Western Australia, and the Pilbara, to a manageable list that targeted one focal mining area. We then conducted a review of the relevant literature and any prior research that was aligned to these species.

## Results

In total, 125 native plant species were investigated, and amongst these, nearly all were identified to be of interest for further assessment and future trialling. Some examples of these are presented in Figure 1.

We confirmed that the majority of taxa (n=113) had some germination issues identified which required certain pre-treatments to assist in germination, but we also found a selection of species that had no such requirements. There were 54 species that had documented uses as human food, and 36 species that had information on medicinal uses. The top plants to be pursued for human food development were from the *Acacia* and *Solanum* genera, but many other species also ranked highly in this respect. These plants have favourable primary nutritive profiles, but also some additional health benefits. A range of plants from the genera *Acacia*, *Grevillea*, *Hakea*, *Sesbania* and *Tribulus* had properties that can be explored for medicinal purposes. At least one third of the plant species had some form of reported other human uses, such as for fuel, timber and resin.

The study also identified candidate species that could be grown to provide feed for livestock (n=33), offer additional agricultural values (n=25), or ecological benefits (n=57). Plants that can offer agricultural benefits, such as nitrogen fixation, or that may pose a weed-risk to crops, were also identified. The documented value of plants as fodder for livestock revealed many candidates such as *Acacia*, *Senna*, *Rhynchosia*, *Tephrosia* and *Owenia*. Some of these, such as species from *Acacia*, *Cajanus*, *Crotalaria*, *Hibiscus*, *Indigofera* and *Senna* also have potential of reducing animal impacts on the environment (i.e. reducing methane emitted from animal gut). Finally, ecological service values were considered, and nearly half of the plants have reported roles in supporting wildlife, stabilising soil, and have high value in rehabilitation. When considering multi-purpose species that may provide a number of these benefits, the most promising species appear to be *Acacia colei*, *A. cowleana*, *A. ampliceps* and *Sesbania cannabina*.



*Senna notabilis* (Cockroach Bush). Medicinal use to treat sores, anthelmintic, laxative.



*Rhynchosia minima* (Mardie Clover). Medicinal use as laxative, anthelmintic, abortifacient. Natural herbicide. High grazing value.



*Crotalaria cunninghamii* (Green Birdflower). Medicinal use as for infections. Used as biomaterial.



*Solanum lasiophyllum* (Flannel Bush). All parts except fruit edible. Eaten by livestock.

Figure 1. Examples of plants identified to be of interest for further assessment

## Discussion

By compiling and synthesising information on aspects such as seed germination, propagation, plant habitats and distribution this study highlighted the capacity for how a selection of Pilbara native plants could be grown and used for sustainable and reliable rehabilitation seed supply. By bringing a range of published information together in one location it assists in quickly identifying common barriers and restrictions that are related to seed germination, growth, supply and cost across species. This synthesis also identified plants that could be grown for bushfood, medicine, fodder or bio-materials and which plants could play a role in conservation, protection and enhancement of biodiversity, increasing resistance to climate extremes. Our synthesis may also be useful when making decisions for diversifying of business incomes, while meeting regional development goals associated native plant product industries.

This report profiled some highly valuable species worth considering for trialling and investment that are identified by the selection and evaluation process based on literature data and pre-existing knowledge. However, as these ratings are based solely on what was available and can be accessed in the literature and what we know about these, the information presented here is therefore not directly recommending, promoting or excluding any specific plants for continuation, but should be used only as a guide for selecting candidates for some immediate opportunities and perusals. Further desktop or practical work on plants is recommended to fill these gaps in knowledge.

## Conclusions

This study revealed that there is an opportunity to explore further the use of native plants not just for rehabilitation, but also as food, novel medicines, crops, pasture/fodder, and other products.

## Acknowledgements

This project was developed in collaboration with BHP's Closure Team. We acknowledge the inputs from Joanne Heyes and Tim Cooper throughout all stages of this project, and the constructive review comments received from Kim Ferguson.

## Conflicts of Interest

There is no conflict of interest.

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