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The Soil Program of the Restoration Seedbank Initiative: addressing knowledge gaps in degraded soils for use in dryland restoration

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Global environmental changes and other anthropogenic impacts are rapidly transforming the structure and functioning of ecosystems worldwide. These changes are leading to land degradation with an estimated 25 % of the global land surface being affected. Landscape-scale restoration of these degraded ecosystems has therefore been recognised globally as an international priority. In the resource-rich biodiverse semi-arid Pilbara region of north-west Western Australia hundreds of thousands of hectares are disturbed due to established and emerging iron-ore mine operations. At this scale, the need to develop cost-effective large-scale solutions to restore these landscapes becomes imperative to preserve biodiversity and achieve functionality and sustainability of these ecosystems.

The Restoration Seedbank Initiative (RSB) (http://www.plants.uwa.edu.au/ research/restoration-seedbank-initiative) is a five-year multidisciplinary research project that aims to build knowledge and design strategies to restore mine-impacted landscapes in the Pilbara and other arid and semi-arid landscapes worldwide (Kildiseheva et al., 2016). The RSB comprises four research programs that focus on seedbank management and curation, seed storage, seed enhancement, and the use of alternative soil substrates (soil or growing medium program) respectively. These multi-disciplinary programs address the significant challenges of landscape scale restoration in arid systems. In the soil program we follow an integrated approach that includes the characterization of undisturbed ecosystems, assessment of restored soils with the use of soil quality indicators, and design of alternative soil substrates to support the establishment of native plant communities. A series of glasshouse studies and field trials have been conducted in the last three years to advance our knowledge on soil limitations and to provide solutions to effectively overcome these challenges in arid ecosystem restoration. These studies include (i) the determination of ecophysiological indicators influencing drought responses of arid native plants in reconstructed soils (Bateman et al, 2016), ii) the analysis of the influence of climate and edaphic factors in the recruitment of arid zone seedlings (Muñoz-Rojas et al., 2016a) and (ii) the evaluation of soil physicochemical and microbiological indicators to assess functionality of restored soils in degraded semiarid ecosystems (Muñoz-Rojas et al., 2016b). Here, we summarize our latest results in the soil program of the RSB, and propose recommendations for integrating soil science in cost-effective landscape-scale restoration practices in ecosystems worldwide.

References

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