**Australian biocrusts in arid land rehabilitation**

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Arid lands encompass over 70% of Australia's mainland and are set to increase and change under predicted climate models. In addition to being biodiversity hotspots, they sustain a range of key industries including agriculture, mining, and tourism. As demand for the resources of arid lands grows, there is inevitably a clash between maintaining ecological productivity and land degradation through continued economic use. Within this context, we seek to understand the natural histories of biocrusts - topsoil assemblages of microorganisms, mosses and lichens – and their potential as agents for arid land rehabilitation.

Using next-generation sequencing, we have profiled biocrust microbiomes at local and intra-continental scales across Australia. Our datasets illustrate the natural status of biocrusts and help establish informed targets to assess and monitor topsoil recovery. The role of cyanobacteria in the formation and maintenance of biocrusts was highlighted. Seasonality of precipitation was identified as a key factor affecting biocrust assembly on an intra-continental scale, indicating biocrust restoration will rely on employing locally-adapted, endemic strains. In addition, we have isolated key biocrust cyanobacteria species and conducted novel microcosm experiments examining the effect of Microcoleus sp. and Nostoc sp. on seedling establishment. We performed bio-priming of seeds with the indigenous cyanobacteria and showed this had significant positive effects on the germination rates of Acacia hilliana and Senna notabilis, two native species used in restoration. Our work highlights the importance of biocrusts in drylands and is developing practical approaches for their integration with current rehabilitation strategies to enhance ecological outcomes.

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