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Diversity and recovery of degraded desert plant communities in response to ecological restoration in Sharaan Nature Reserve, AlUla, Saudi Arabia

R. Sallio[1], S. Youssef[1,*], L. Maris[1], M.D. Miara[1,2], K. Maurice[3], B. Kerfriden[1], J. Nespoulous[1], S. Boivin[1], H. Boukcim[1], S.D. Almalki[4], **A.H. Mohamed**[4,5] and B.P.Y-H. Lee[4]

[1]Department of Research and Development, Valorhiz, Montpellier, France
[2]Department of Ecology and Biotechnology, Faculty of Nature and Life Science, lbn Khaldoun University of Tiaret, Tiaret, Algeria
[3]LSTM, Univ Montpellier, CIRAD, INRAE, IRD, SupAgro, Montpellier ,France
[4]Wildlife and Natural Heritage, RCU – Royal Commission for AlUla, AlUla, Saudi Arabia
[5]Plant Ecology and Rangeland Management, Desert Research Center, Cairo, Egypt

[*]Corresponding author email: sami.youssef@valorhiz.com

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Identifying reference plant communities (RFC) is the cornerstone concept in any restoration ecology initiative. In practice, the selection of RFC is often challenged by the lack of data before degradation of the natural ecosystem occurred. This is a common situation in arid lands of the Arabian Peninsula where past anthropogenic activities, such as agriculture, leave persistent legacies on vegetation dynamics even decades after abandonment. The vulnerable natural ecosystems of Saudi Arabia have witnessed a dramatic impact from agriculture activities over the past century, leading to disruptions in the natural equilibrium and causing widespread ecosystem degradation. Restoring these arid ecosystems poses significant operational challenges to practitioners due to harsh environmental conditions, sometimes extending to more than a year without rainfall. Given these challenges, the selection of a suitable key species is crucial to ensure the survival of seedlings and the overall success of ecological restoration initiatives. In this study, we tested a regional plant–environment interaction approach to select the most similar non-degraded site as a reference for restoring degraded habitats. The effectiveness of this approach in arid environments is evaluated in Sharaan Nature Reserve, Saudi Arabia. By analysing plant communities and soil properties of five natural and 11 degraded habitats, with varying degradation histories, we identified four major reference habitats and communities that could help to propose an appropriate plant species palette for ecological restoration. Our results show no significant relationship between plant communities and spatial distribution of sites. More surprisingly, no significant relationship between plant communities and soil properties was found suggesting that plant community establishment is more explained by other biotic and/or abiotic factors than soil properties. This study supports the efficiency of this approach to identify reference habitat and plant communities allowing for the appropriate choice of a target species for ecological restoration of arid environments.