Pedology and plant provenance can improve predictions of species distributions of the Australian native flora: a calibrated and validated modelling exercise on 5,033 species

Farzin Shabani[1], Mohsen Ahmadi[2], Niloufar Lorestani[1], Shazia Bibi[1], Atefeh Esmaeili[1], Tessa Lane[3], Martin Breed[4], John Llewelyn[3], Craig Liddicoat[3], Philip Langat[5], Bahareh Kalantar[6], Nadiezhda Ramírez-Cabral[7], Pooja Singh[8], Ricardo Siqueira[9], Mohammed Abu-Dieyeh[1], Masoud Nazarizadeh[10], and Alessandro Ossola[11]

[1]Qatar University College of Arts and Sciences
[2]Isfahan University of Technology
[3]Flinders University College of Science and Engineering
[4]Flinders University
[5]Central Queensland University
[6]RIKEN Center for Advanced Intelligence Project
[7]National Institute of Forestry Agriculture and Livestock Research
[8]University of California Davis
[9]Universidade Federal dos Vales do Jequitinhonha e Mucuri
[10]University of South Bohemia in Ceske Budejovice Faculty of Science
[11]University of California Davis Department of Plant Sciences

January 29, 2025

Abstract

Species distribution models (SDMs) are valuable tools for assessing species' responses to environmental factors and identifying areas suitable for their survival. The careful selection of input variables is critical, as their interactions, and correlations with other environmental factors can affect model performance. This study evaluates the influence of climate and soil variables on SDMs' performance for 5,033 Australian plant species, selected to represent the largest phylogenetic diversity of native terrestrial vascular flora. Using an ensemble of correlative models, we assessed the predictive performance of climate and soil variables, individually and in combination, across four distinct ecoregions: Desert (n = 640 species), Mediterranean (n = 1,246), Temperate (n = 1,936), and Tropical (n = 1,211). Our results demonstrate that on a continental scale, climate variables have a greater influence on plant distributions than soil variables. Although incorporating soil and climate variables enhanced model performance in some ecoregions, our results indicate that relying solely on small-scale variables such as soil may increase the likelihood of overfitting. In soil-only models, Clay content (CLY), Nitrogen Total Organic (NTO), and Soil Organic Carbon (SOC) were important across modelled species, with their relevance varying by ecoregion. Our findings have significant implications for understanding the interplay between climate, soil, and plant distribution within diverse ecoregions. By highlighting the crucial role of climate in large-scale models, this study serves as a foundation for developing more accurate predictions of plant distributions, ultimately improving model accuracy for biodiversity assessments.

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