Potential geographic distribution of *Rhizophora apiculata* Blume under different future climate change and sea level rise scenarios

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Abstract

Species distribution models (SDMs) are a common tool used to link occurrence data and environmental predictors to project species' potential geographic distributions in response to climate change. While SDMs have been applied to many taxa, there are few examples of SDMs for mangroves. We present one of the first examples of a mangrove SDM for *Rhizophora apiculata* Blume. Occurrence data from the online Mangrove Reference Database and Herbarium were used to fit the models. We chose a suite of predictor variables that were relevant to the biology of the species and were not correlated: minimum annual air temperature, mean annual precipitation, horizontal tide, distance from coast, and river discharge. Models were fitted to 70% of the occurrence data using MaxEnt software and current climate data from the Worldclim database. The remaining 30% of the occurrence data were set aside as a holdout dataset for model validation. We projected *R. apiculata*'s future potential distribution in 2080 under different future climate and sea-level rise (0, 1, 3, and 6 m) scenarios.
The model exhibited excellent predictive performance with an Area Under the Operating Curve value of 0.917 ± 0.03. An analysis estimating the relative contributions of each predictor to the model showed that the first and second most important predictors were distance to coast and minimum annual air temperature, respectively. Under all future climate and sea level rise scenarios, the projected percentage of coastal *R. apiculata* occurrences increased by 5-9%. These areas of increased occurrences were primarily along the western coasts of India and northern Australia. These projections may be optimistic because the models do not account for dispersal limitation or localities projected to be inundated with sea level rise that have unsuitable substrate (e.g., developed urban areas).

Keywords
climate envelope, southeast Asia, Australia