Estimating the suitability of tree species in future climates with the TreeGOER, GlobalUsefulNativeTrees, CitiesGOER and ClimateForecasts databases

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The Global Biodiversity Standard (TGBS) is the world's only international standard that recognises and promotes the protection, restoration, and enhancement of biodiversity. In support of the goals of TGBS to mentor and provide knowledge to tree planting groups and their supporters about land management practices that follow the 'golden rules for tree planting', several new global databases have been developed. These include the Tree Globally Observed Environmental Ranges (TreeGOER) database which provides information on the environmental ranges for 48,129 tree species, the GlobalUsefulNativeTrees (GlobUNT) database which provides information on the native country (and, for larger countries, also the subnational) distribution and uses for 14,014 tree species, the CitiesGOER database which provides environmental conditions for 52,602 cities, and the ClimateForecasts database which provides environmental conditions for 15,504 weather station locations. TreeGOER provides the environmental ranges for 38 bioclimatic variables (e.g., maximum temperature of the warmest month or the Climatic Moisture Index), eight soil variables and three topographic variables. CitiesGOER and ClimateForecasts document environmental conditions for the same variables for historical (1970–2000) and three future climates, for low and high emission scenarios. Since they contain information for the same environmental variables, these databases can be combined to calculate the position of a planting location in environmental space with respect to the environmental ranges of species included in TreeGOER. One of the methods to combine these databases and calculate a climate suitability score is provided through the treegoer.score() function of the BiodiversityR package in the R programming environment. For species included in GlobUNT, users can directly select a weather station location in the R shiny app to calculate climate scores for filtered tree species. Besides applications in helping restoration projects to adopt criteria of TGBS, the databases can also be readily used to design climate adaptation plans for any botanical garden.