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Assessing the coexistence of Mediterranean oak species having different hygrophilia

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In a previous work (Di Paola et al., 2011) we defined a mathematical model to explain the observed copresence of trees having different responses to water stress (i.e. drought sensitive but flood resistant (hygrophilous species) and vice versa (non-hygrophilous species)). The model admits different equilibria, the most interesting of which is that of coexistence for which we found out the necessary condition for its stability and biological meaningful.
Such model predicts that a stable forest with coexistence of both the species must have an evapotranspiration (ET) that ranges between the ETs that occur in the cases of stable forests with single species.
With the present work we want to test the validity of the model on the copresence of typical endemism of deciduous and evergreen oaks species of the Mediterranean.
Justifications are: oak trees represent the vegetation climax stage in the Mediterranean climate type. There are many observed and cited cases of such copresence in literature and most of them are explained by the different responses to water stress between deciduous and evergreen leaf habit. Lastly, the Mediterranean climate, characterized by hot dry summers and rainy winters, subject these species to the double stress of summer drought and flood winter (dynamics on which the model focuses on). To do that we mainly use 3 open source dataset: 1) the Modis actual evapotranspiration global maps, from which we derived the mean annual evapotranspiration of the period 2000-2011; 2) The mean actual evapotranspiration global map (period 1950-2000, supposing a land cover of green grass) provided by the CGIAR-CSI; 3) the European tree species distribution provided by the Joint Research Center from which we extracted the distribution of the main endemic oaks species of the Mediterranean area.
The results show that i) the choice of leaf habit (Deciduous vs. Evergreen) as a proxy for hygrophilous and non-hygrophilous distinction is reasonable for this case study; ii) the model is consistent with the data, although they cannot validate it in a absolute sense. Despite the high spatial resolution of the data sets (i.e 0.0083 * 0.0083 ° degree) the ETs data are not enough accurate to validate the coexistence model; iii) data show cases of copresence at relatively high rates of mean annual ET (about 900 mm/Yr) that may disclose some mechanisms of facilitation/complementarily not considered by the model. Finally, the combination of data of species distribution together with the climate ones represents a simple but useful way to investigate plants functional traits.