Biogeographical modelling of the species competitive interactions: a fuzzy logic Approach

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The environmental conditions of a territory determine to what degree the species are related to each other and to the environment. Species distribution models are used to establish relationships between the environment and the species distribution. Models based on fuzzy logic through the Favourability Function also allow the análisis of relationships between distributions of different taxa. By considering how the environment influences competition relationships between two species, we proposed the biogeographic analysis of three posible scenarios: i) sympatric coexistence; ii) environmental segregation; and iii) competitive exclusion. In order to identify these scenarios in different pairs of species with overlapping distributions, the Favourability Function and fuzzy logic tools were applied. Specifically, for each case, the favourability for each species and the fuzzy intersection between them, or "shared favourability", was calculated. For each case, the relationship between the favourability for each species and the shared favourability was analyzed, highlighting the areas where either environmental segregation, competitive exclusion or sympatric coexistence is predicted. The results showed that the Favourability Function is a useful tool for analyzing large-scale biogeographical outcomes of ecological interactions between species.