

Fuzzy logic is a helpful conceptual and operational tool for modelling the geography of ecological interactions

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Abstract: Fuzzy logic is a form of many-valued logic whose variables have a truth value that varies in degree. Spatial favourability for species occurrence may be considered a fuzzy concept, as historical, geographical, human, and environmental conditions make locations more or less favourable for the occurrence of particular species. The favourability function was conceptually conceived to define spatial favourability in a fuzzy gradient from 0 to 1, so facilitating the application of fuzzy logic to spatial modelling. Favourability values derived from the favourability function have the same meaning and the same mathematical value regardless the prevalence of the species, so enabling direct comparison of models built for different species and their combination using fuzzy logic operators. This characteristics make the favourability function particularly useful in the spatial modelling of ecologically interacting species. In particular, the fuzzy intersection of favourability for different species is useful to model the biogeographical consequences of different degrees of competition between species. Fuzzy logic operations allow also to combine autoecological and sinecological responses in a way that may account for the existence of parapatric distributions in current and future environments, as exemplified by hare species in Europe. Fuzzy logic may provide biogeographical modellers with the necessary flexibility in concepts and operational tools to deal with a highly unstable and intertwined biogeographical world.