

Publication

A new conceptual and methodological framework for exploring and explaining pattern in presence – absence data

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A conceptual framework is proposed to evaluate the relative importance of beta diversity, nestedness and agreement in species richness in presence-absence data matrices via partitioning pairwise gamma diversity into additive components. This is achieved by calculating three complementary indices that measure similarity, relative species replacement, and relative richness difference for all pairs of sites, and by displaying the results in a two-dimensional simplex diagram, or ternary plot. By summing two terms at a time, three one-dimensional simplices are derived corresponding to different contrasts: beta diversity versus similarity, species replacement versus nestedness and, finally, richness difference versus richness agreement. The simplex diagrams can be used to interpret underlying data structures by showing departure from randomness towards well-interpretable directions, as demonstrated by artificial and actual examples. In particular, one may appreciate how far data structure deviates from three extreme model situations: perfect nestedness, anti-nestedness and perfect gradient. Throughout the paper, we pay special attention to the measurement and interpretation of beta diversity and nestedness for pairs of sites, because these concepts have been in focus of ecological research for decades. The novel method can be used in community ecology, conservation biology, and biogeography, whenever the objective is to recover explanatory ecological processes behind patterns conveyed by presence-absence data.

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