

Analyzing spatial multivariate structures

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Standard multivariate analysis methods aim to identify and summarize the main structures in large datasets containing the description of a number of observations by several variables. In many cases, spatial information is also available for each observation, so that a map can be associated to the multivariate dataset. Two main objectives are relevant in the analysis of spatial multivariate data: summarizing covariation structures and identifying spatial patterns. In practice, achieving both goals simultaneously is a statistical challenge, and a range of methods have been developed that offer trade-offs between these two objectives. In an applied context, this methodological question has been and remains a major issue in community ecology, where species assemblages (i.e., covariation between species abundances) are often driven by spatial processes (and thus exhibit spatial patterns).

I review a variety of methods developed during the last decades to investigate multivariate spatial patterns. I present different ways of incorporating spatial constraints in multivariate analysis (e.g., geographical distance, spatial partition, polynomial of geographical coordinates, spatial graph) and discuss the properties of these different approaches both from a practical and theoretical viewpoint.