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## Ecological Modelling

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# All-scale spatial analysis of ecological data by means of principal coordinates of neighbour matrices

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### Abstract

Spatial heterogeneity of ecological structures originates either from the physical forcing of environmental variables or from community processes. In both cases, spatial structuring plays a functional role in ecosystems. Ecological models should explicitly take into account the spatial structure of ecosystems. In previous work, we used a polynomial function of the geographic coordinates of the sampling sites to model broad-scale spatial variation in a canonical (regression-type) modelling context. In this paper, we propose a method for detecting and quantifying spatial patterns over a wide range of scales. This is obtained by eigenvalue decomposition of a truncated matrix of geographic distances among the sampling sites. The eigenvectors corresponding to positive eigenvalues are used as spatial descriptors in regression or canonical analysis. This method can be applied to any set of sites providing a good coverage of the geographic

sampling area. This paper investigates the behaviour of the method using numerical simulations and an artificial pseudo-ecological data set of known properties.



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## Keywords

Geographic distances among sampling sites; Principal coordinate analysis; Variation partitioning; Scale; Spatial analysis

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