

# Partitioning beta diversity in landscape ecology and genetics

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Beta diversity is the variation in species composition among sites within a geographic area of interest. It can be measured in different ways. Among these, the total variance of the community data table  $Y$  is an estimate of beta diversity. We show how the total variance of  $Y$  can be calculated either directly or through an ecological dissimilarity matrix. This measure can be generalized to any community dissimilarity index. We address the question of which index to use by coding 16 indices using 14 properties that are necessary for beta assessment, comparability among data sets, sampling issues, and ordination. Our comparison analysis classifies the coefficients under study into five types, three of which are appropriate for beta diversity assessment. The total variance of  $Y$  links the concept of beta diversity with the analysis of community data by commonly used methods like ordination and analysis of variance. Total beta can be partitioned into Local Contributions of individual sites to Beta Diversity (LCBD: comparative indicators of the ecological uniqueness of the sites) and Species Contributions to Beta Diversity (SCBD: degree of variation of individual species across the study area). These new indices can be tested for significance. High LCBD values single out sites that have unusual species combinations and high conservation values, as well as degraded and species-poor sites in need of ecological restoration. Moreover, total beta can be broken up into within- and among-group components by multivariate analysis of variance (MANOVA), into orthogonal axes by ordination, into spatial scales by eigenfunction analysis, or among explanatory data sets by variation partitioning. LCBD indices can also be computed for genetic data, using genetic distances, in the framework of landscape genetics.

## Reference

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