SPHERES, POLYTOPES, NEIGHBOURS, PATHS AND TREES: ECOLOGICAL AND MORPHOMETRIC ASPECTS OF MULTIDIMENSIONAL SPACE

TEMPLE, J. T., Birkbeck College, Malet Street, London WC1E 7HX, U.K.

Close-packed spheres do not fill multidimensional space, so ecological niches must be space-filling polytopes. The size of such polytopes depends on the effective dimensionality of the environment: in ecospace of low dimensions (rigorous or peripheral environments) the niches are large, their centres far apart, and the occupying species eurytopic; in ecospace of higher dimensions (e.g. tropical rain forests) the niches are smaller and closer together, with specialised occupants.

The concordances between phenetic distance matrices based on Euclidean, Manhattan, Mahalanobis and Hausdorff distances decrease with increasing number of dimensions (k). The Euclidean/Manhattan concordance is strongest: here the probability of identity of nearest-neighbour decreases to a limit of about one-half for $k > 40$. The nearest-neighbour configuration of the Hausdorff metric is the most stable during increase in dimensions.

The shortest unbranched path is an alternative to the minimum spanning tree (MST) for linking multivariate data points in situations where seriation rather than ordination is appropriate.