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## Spatial Structure Analysis Using Three Different Approaches

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### Abstract

Forest structural diversity, which may be defined as the diversity of tree species and tree dimensions and their spatial arrangement, can be indicative of overall biodiversity and habitat suitability. The ability to assess and to describe spatial structures with affordable cost is the key to managing uneven-aged multi-species forests. The knowledge of forest structure is useful in forecasting tree growth and for monitoring the modifications caused by timber harvesting operations. Many authors have suggested variables that can be used to describe forest structure and diversity, and numerous structural indices have been proposed. To assess the different scales and levels of forest structure within a given area, more integrated and comprehensive approaches are required which include not only species diversity (i.e., mixture), but also the distribution of the tree positions (i.e., spatial distribution) and the special arrangement of the tree dimensions (i.e., size differentiation). One of the main problems is to characterise and describe forests with different spatial characteristics more accurately, using affordable assessment techniques. This study describes an analysis of three groups of indices: **(1)** aggregation index of Clark and Evans combined with the segregation index of Pielou and the Shannon index (i.e., macroscale structure analysis), **(2)** the three neighbourhood-based parameters “contagion”, “species mingling” and “dominance” (i.e., microscale structure analysis), **(3)** pair-correlation function and Mark-correlation function which is based on point pattern analysis (i.e., surface analysis). The specific forest structures were studied using fully enumerated plots with measured tree positions from three different forest types: a subtropical forest from Southern Africa, a temperate forest from Europe and a boreal forest from Northern Mongolia. The neighbourhood-based variables proved to be equally effective as the other variables for characterising small-scale differences of forest structure, but have the advantage that they are easier to assess during forest inventories than the traditional measures of forest spatial structure and diversity.

**Keywords:** Aggregation index of Clark and Evans, neighbourhood-based parameters, point pattern analysis, segregation index of Pielou, Shannon index, spatial forest structure