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Determination of optimal plot size for tropical lower land rain forest

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Sinharaja forest is the largest block of relatively undisturbed lower land evergreen rainforest in Sri Lanka. Due to the expanded area, a complete inventory method cannot be used to analyze the species distribution. Finding a most suitable sampling plot, which represents the entire population, is also a difficult task. In this study, determination of optimal plot size for a tropical lower land rain forest is done using multivariate methods, namely the cluster analysis, correspondence analysis, non-metric multidimensional scaling and procrustean analysis. Average, complete, wards and single linkage methods were applied to select the most suitable hierarchical clustering method to the full data set. Plot sizes selected for the study are 5 x 5 m^2, 5 x 10 m^2, 10 x 10 m^2, 10 x 20 m^2 and 20 x 40 m^2. Based on the cophenetic correlation co-efficient, it was revealed that the average linkage method is the most robust hieratical clustering method. The results obtained from the cluster analysis are verified using ordination techniques, namely, correspondence analysis (CA), detrended correspondence analysis (DCA), principal coordinates analysis (PCoA), and non-metric multidimensional scaling (NMS). The solutions produced by these methods were then compared using procrustean analysis. According to the procrustean rotations CA and NMS pair has the highest correlation, and procrustes sum of squares of pair wise rotations show that NMS has the lowest sum of squares with CA. However, ordination plots drawn by using NMS show clear differences among all 25 sites than the ordination plots drawn by using CA. Therefore, the NMS method can be used as the most robust ordination method for forest data analyses.

Relative variance of species cover per unit area is used to determine the optimal plot size, assuming that the time for the sampling work is constant for six plot sizes. Based on the analysis, 20 x 40 m^2 plot is chosen as the optimal plot size, which represents highest species cover per unit area. Mantel test indicates that the species of 20 x 40 m^2 plots are highly correlated with 20 x 20 m^2 plots. This result is verified using average linkage method and NMS ordination. The final results indicate that 20 x 40 m^2 is the most suitable rectangular shaped plot, and 20 x 20 m^2 is the most suitable square shaped plot, which represents the highest number of species cover per unit area.

Keywords: Cophenetic correlation, hierarchical clustering, ordination, procrustean analysis

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