Estimation of Broad-Scale Plant Richness: Individual-Based Or Spatially-Constrained Rarefaction?

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Abstract

Rarefaction may be the most reasonable approach for estimating broad-scale plant richness using herbarium data. It is based on repeatedly drawing subsets of n specimens from the pool of all N specimens collected in a region, to estimate the average number of species represented in subsets of n specimens, $E[S_n]$. We studied the performance of two types of rarefaction. In particular, we examined the hypothesis that estimates obtained by spatially-constrained rarefaction, $E[S_{n.scr}]$, are less biased than estimates obtained from individual-based rarefaction, $E[S_{n.r}]$, because spatially-constrained rarefaction reduces over-estimation due to spatial aggregation of collecting activities. We tested the several predictions using estimates of plant richness for 153 grid cells of 5 x 5 km located across Nicaragua. There were $N \geq 200$ herbarium specimens collected in each of the grid cells, all georeferenced and determined to species. We found empirical support for the prediction that: individual-based rarefaction tends to produce higher richness estimates than accumulation curves; produce higher richness estimates than spatially-constrained rarefaction; the difference between estimates produced by that individual-based and spatially-constrained rarefaction increase with grid cell sampling (*N*) relative to the number of specimens at which rarefaction is performed (*n*).