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A design-based view of species richness estimation

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For the first time, estimation of species richness is approached from a design-based perspective in which the properties of estimators are derived from the schemes actually adopted for sampling ecological communities, without any unrealistic assumption about sampling and communities that are widely exploited in model-based approaches. Probabilistic sampling of species is considered, and the widely applied estimators automatized in the SPADE software, continuously improved in an R-based version referred to as SpadeR (Chao et al. 2015), are considered in a design-based setting. A simulation study performed on two real communities of trees highlights the massive presence of negative bias due to loss of rare species that invariably affects the SPADE estimators. Then, a data integration is attempted in which the lists of rare species usually compiled by purposive surveys are exploited and richness estimation is performed on the residual community of those species not included in the purposive lists. The Chao & Lee (1992) estimator is adopted for estimating the residual richness and a bootstrap mean squared error estimator is applied. The strategy has been empirically checked by the same simulation study adopted for checking SPADE estimators, achieving much better and encouraging results. The proposal is applied to estimate the richness of plant species in chestnut forests of Sabatini Mountains (Central Italy).

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