Analysing plant cover class data quantitatively: customized cumulative beta distributions show promising results

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Abstract: Plant abundance data (such as Braun-Blanquet cover classes) are more often analyzed with ordination techniques than with parametric ones, even if the latter allow for a more interpretable quantification and a better comparison between studies than the former. Among parametric techniques, only the cumulative logit model takes into account all the peculiarities of these abundance data: bounded between 0 and 100%, asymmetric classes, high proportion of zeroes. However, the results that the cumulative logit model provides are difficult to interpret. Here we propose twelve Bayesian models based on a zero-inflated cumulative beta probability distribution which is bounded, can assume various shapes and accounts for zeroes, therefore taking into account the peculiarities of abundance data. Moreover, results of those models are easy to interpret since the user can directly estimate the mean and variance of data underlying abundance class observations, much as in generalized linear models (GLMs). We applied our new models and the cumulative logit model to real data: Braun-Blanquet abundance of 17 understory species in response to two dendrometric biodiversity indicators (tree cover and specific richness). We compared the performance of the models using the Deviance Information Criterion and sampled posterior p-values. Four of the Bayesian beta models consistently outperformed the cumulative logit model and showed an ease of interpretation similar to that of GLMs. They therefore provide promising alternatives to existing parametric methods for modeling plant abundance.