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# Patch dynamics as principal driver of weed species assembly

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## Abstract

The metacommunity framework explores the relative influence of local and regional-scale processes in generating diversity patterns. In metacommunity dynamics, spatial dispersal is a key process to maintain diversity in complex community networks. However, organisms may also be subjected to temporal dispersal, particularly plants with dormant seeds. Moreover, metacommunity models assume spatial environmental heterogeneity, whereas organism living in ephemeral habitat also face temporal variation in habitat availability and quality. Here, we explored the ability of patch-dynamics, species-sorting, mass-effects, and neutral metacommunity models to explain empirical patterns of temporal changes in weed community composition. We hypothesized that weed community assembly would be strongly affected by patch dynamics because of temporal variations of weed habitat availability and quality created by the crop succession. We calculated temporal weed beta-diversity indices and quantified the importance of crop sowing dates (a proxy of patch availability), annual environmental conditions, temporal environmental heterogeneity between two annual communities and temporal distance using linear mixed models. We found that temporal weed beta-diversity was mainly explained by crop sowing date differences suggesting that patch-dynamics was the principal driver of weed community assembly. Respective weight of temporal heterogeneity of environmental conditions and then of annual environmental conditions highlighted the existence of species sorting mechanisms. We lastly revealed an effect of temporal distance in plot receiving no herbicides, suggesting a temporal mass effect masked by herbicides sprayed. Overall, our study reveals the importance of considering both temporal dispersal and temporal variation of environmental conditions when investigating processes generating diversity patterns in ephemeral habitats.

**Keywords:** ephemeral habitat, temporal beta diversity, crop sequence, temporal environmental heterogeneity

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