Local and regional components of diversity in abandoned fields

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The spatial pattern of biodiversity arises from the interaction of local, regional and biogeographic processes. The patterns generated by these processes are described by the concepts of α-, β- and γ-diversity: α-diversity is assumed to be the outcome of local ecological interactions (e.g. competition), whereas β-diversity between habitats is triggered by environmental differences between habitats. γ-diversity is the pool of species which feeds the two local components of diversity. However, the processes generating the interactions of these three scales of biodiversity are poorly understood.
We used the data of abandoned fields from 4 localities in SO-Germany. On these fields succession was allowed to start in autumn. In the area of Bad Lauchstädt a further succession experiment was additionally started in spring. To characterize the germination strategies of species at 18 randomly placed plots at Bad Lauchstädt (1 m^2 each) all emerged seedlings were removed and counted at eight sampling dates throughout the first year of succession. For all species with 20 or more individuals we calculated the mean time of germination and the breadth of the germination window. The following results were found:

1. The mean number of species on the 4m^2 plots (α-diversity) differs between regions. Regional differences explain about 60% of the variability of α-diversity. The number of species is significantly lower on the plots where succession started in spring compared to nearby plots where succession started in autumn. The difference is in the same order of magnitude as regional differences of α-diversity.

2. The germination strategy varies considerably between species. Some species germinate during the whole year (e.g. *Agropyron repens, Senecio vulgaris*), some germinate in autumn (*Lactuca serriola, Conyza canadensis*) and some germinate during spring or summer (*Fallopia convolvulus, Amaranthus blitoides*). We found significant correlations (one-tailed) between the mean time of germination of a species and the cover/abundance data.

3. The breadth of the germination niche is not correlated to the cover/abundance estimates in the two treatments (one-tailed tests $p>0.15$ in both cases). However, the breadth of the germination niche is well correlated with the regional distribution of species, measured by the number of grids (11 x 11 km) where the species was recorded in Germany (SCHÖNFELDER UND HAEUPLER 1988). Species which are able to germinate throughout the whole year may have more chances to find a safe site for germination and become more widespread compared to specialized species.

From these results following conclusions can be drawn:

1. α-diversity is influenced by the regional species pool.
2. Species composition, however, depends on the time window of disturbances.
3. The germination strategy of a species is an important character which triggers local abundance and regional distribution of weeds on arable land.

Literatur

SCHÖNFELDER P.UND H. HAEUPLER (1988): Atlas der Farn- und Blütenpflanzen der Bundesrepublik Deutschland.

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