

Analysing biodiversity ecosystem functioning experiment using mechanistic models

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The biodiversity ecosystem functioning (BEF) is an actual thematic linking biodiversity with productivity of an ecosystem. In general, It has been found that higher biodiversity implies higher productivity. Understanding how species traits impact the community dynamics and, consequently, the relationship between biodiversity and productivity is of key importance. Here, we re-analyzed the data of the Jena BEF study using mechanistic models of community dynamics. Jena experiment is a long term experiment (since 2002 and still running) set in the city of Jena in Germany, which aim at studying the BEF relationship by manipulating species richness and composition. They use a set of 60 species and sown plots with diversity of 1, 2, 4, 8, 16, and 60.

Using the data from the monoculture and the polyculture experiment, we determined the dynamical parameters, i.e., carrying capacity and interaction strength. We assembled a data set of plants traits (specific leaf area, height, leaf mass, and leaf size) and extracted their phylogeny. Then we investigated the relations between the traits and the dynamical parameters.

We found that the carrying capacity is negatively correlated to the specific leaf area (SLA), whereas it is almost always positively linked to the other traits (height, leaf size, and leaf mass). Moreover, we did not find a phylogenetic signal in the carrying capacity.

The we study how the interaction strength between two species is linked to their traits and also to their carrying capacity. We found a strong correlation between the pairwise interaction strength and the carrying capacities ratio in plot of two coexisting species. This indicates the existence of a condition between the carrying capacities and the interaction strength for coexistence. We explain how this condition can be understood from coexistence theory. Regarding the correlation with species traits ratio, we found either positive or negative correlations. We found a negative correlation between the mean interaction strength and the mean phylogenetic distance in plot of two species, however this correlation disappear when including more diverse plots.

Finally, we studied species extinctions and determined the characteristic of the surviving species. Specifically, we study the carrying capacity and showed that the average carrying capacity of the survivors is in general larger than what we could expect at random.

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