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Coupling coexistence theory to field experiments reveals a complex matching between the species' differences modulating diversity and functioning

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Ecologists have argued for decades that exist a parallelism between the mechanisms determining species diversity and those driving functioning in a community: stabilizing niche differences underlies the positive complementary effects of diversity on community function, and differences in species' fitness are related to differences in species' selection effects. However, recent theoretical advances suggest that this parallelism does not occur, instead, complementarity effects results from the interaction of niche and fitness differences and the same is true for selection effects. We empirically tested these novel predictions by coupling a competition experiment to a diversity-multifunctioning experiment with ten annual plant species. We additionally included an extreme drought treatment to explore how abiotic conditions changes these relationships. We clearly found that more diverse communities produced more biomass, litter was decomposed faster, and soil nutrients were more abundant. Moreover, drought reduced this overall functioning as well as niche and fitness differences between species. Could we then establish that this reduction in multifunctionality was caused by lower niche and fitness differences between species? The answer is no as results revealed a diverse range of relationships. For biomass and soil nutrients, complementarity effects between species pairs were explained only by niche differences and differences in selection effects only by fitness differences, supporting the classical parallelism. For litter decomposition, only complementarity effects were explained by the interaction of niche and fitness differences, partly supporting the novel predictions. Our results suggest that common linkages between the species' differences modulating diversity and functioning across multiple functions do not occur.

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Estimating species richness with hierarchical occupancy-detection models: what to expect

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Species richness is a fundamental measure that underlies many ecological models and conservation strategies. Since detection is often imperfect in wildlife surveys, studies of richness patterns that are based on metrics obtained from raw "presence-absence" data risk that real patterns are masked or spurious patterns falsely identified. Recognition of this problem has led to the development of several statistical methods for inferring the number of unobserved species at a site or incorporating information on species detectability in community analyses. In this presentation, we focus on a promising community-modelling framework, applicable to spatially- and temporally-replicated samples (Dorazio et al 2006, Ecology). Its philosophy is that species richness and other attributes of community structure are best described using models of individual species occurrence that explicitly account for imperfect detection during sample collection, i.e., combining single-species occupancy-detection models. By linking individual models in a hierarchical fashion, the method also provides inference about the number of species that completely eluded detection. This modelling framework has been used in a limited but growing number of studies and, given its apparent power and relative ease of implementation, is expected to attract increasing attention from community ecologists. However, its potential and limitations are not yet well understood. In this presentation, we first provide an intuitive explanation of the method, and clarify what its estimates represent. We then assess estimation performance under a range of plausible scenarios, including the impact of model assumption violations. Our results will guide community ecologists wanting to apply this method to their studies.