

Irena Šímová
Center for Theoretical Study, Charles
University, Jilská 1, 110 00 Prague, Czech
Republic
Department of Ecology, Faculty of Science,
Charles University, Viničná 7, 128 44 Prague,
Czech Republic

Review of the Thesis of Ales Lisner

Mechanisms behind diversity and ecosystem functioning relationships – the insights from observational and manipulative studies in grassland communities

The thesis of Mgr. Ales Lisner focuses on a popular biodiversity-ecosystem function research field but goes somewhat against the scientific consensus that diversity promotes higher biomass production. Therefore, although not published in such high-impact journals as the studies supporting this consensus, I find the results particularly relevant for the scientific community.

The thesis comprises five chapters detailing different aspects of the diversity and ecosystem functioning relationship, from observational to real-world experiments. Ales is the first author of all five chapters, four already published in remote ecological journals. From the thesis, it is clear that Ales has a good knowledge of the field. He states clear hypotheses and uses appropriate data and novel methods to evaluate them. The introduction section nicely summarises the topic, logically connects all the chapters and explains key terms. The text is well written, the sequence of papers is logical, and they all fit the central topic well. The only chapter where the relevance to the key research question seemed weaker was Chapter 4, which focuses on the relationship between plant functional traits and species abundance in a different grassland type than in the previous chapters. Hence, its connection with other results was not fully clear. Overall, I consider the thesis to contain important new information on the biodiversity-ecosystem function research field.

As I have said, the thesis consists of four papers published in high-impact journals, meaning that they have already undergone several rounds of reviews from experts in the field consisting of coauthors, editors and reviewers. I do not consider myself an expert in the biodiversity-ecosystem function relationship, which I am just observing with interest from a

distant macroecological point of view. Consequently, my question will be primarily conceptual.

Question 1

I lack a clear definition of the key term, ecosystem function or functioning. The definition provided on the first page of the thesis seems rather vague, and I do not see a justification for the shortcut from the "variable processes and interactions among plants, animals and microorganisms affecting surrounding environment" to a single variable of biomass production which is central to the topic of this thesis. As the concept of ecosystem services follows this definition, I assume that biomass production is regarded here as a function related to (or beneficial to) humans. I fully support the importance of real-world experiments as they can give us a more realistic picture of the studied processes. But still, why is biomass production and its stability of real-world assemblages such an important function of natural ecosystems (presumably providing a service to human well-being)? I can understand that experimental classical BEF studies focusing on agricultural plants and crops (which is often not the case of classical BEF studies) could be informative for securing agricultural production (and protecting diversity if the link is there). I also understand that biomass production in real-world systems is important in forests. However, I am struggling with whether we need natural grassland ecosystems to be productive as much as possible and the production to be temporarily stable. I imagine some highly productive invasive species (*Heracleum mantegazzianum*, *Reynoutria*) where the amount of produced biomass can be problematic. Can you explain what you mean by ecosystem function in more detail and why your real-world measure of it is important?

Question 2

Chapter 1: I fully support the idea of using different productivity estimates. Nevertheless, the theoretical justification for the role of soil nutrients was unclear. It seems to me that it mostly just reflects the intensity of the management and the difference between the regions. Indeed, you use it in this sense to interpret the results concerning the belowground productivity. How do you expect the particular soil nutrients and pH to form the species-productivity relationship (not just between but also within the regions), and what is the mechanism? Similarly, what form of the SRPR do you expect based on belowground biomass production?

Question 3

Chapter 2: Do you have any idea how to separate the selection effect from the complementarity effect in real-world communities where environmental heterogeneity is present?

Additionally, based on your results from Chapter 1, what do you think about the possible effect of diversity on belowground (instead of aboveground) biomass production, as the competition for light may not be so apparent here?

Question 4

Chapter 4: I am a bit skeptical about the causality of the statement that species abundance patterns are shaped by intraspecific trait variability, which you also discuss in your chapter. Why do you prefer this direction of causality and not the reversed one? Cannot these results be an output of the intra- vs. inter-specific competition variation that likely depends on species abundance and productivity and can be an important driver of interspecific trait differences along a productivity gradient?