**Biogeosciences
Discussions**

Interactive comment on "Biodiversity for multifunctional grasslands: equal productivity in high-diversity low-input and low-diversity high-input systems" *by* A. Weigelt et al.

Anonymous Referee #2

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General comments

The authors present an interesting experiment where they investigate interactions between diversity and management intensities as they affect overall productivity. The results show that the highest diversity treatment yielded a greater improvement in productivity over the lowest diversity treatment in the experiment than the range of management intensities used in the experiment. There are additional interesting results about interactions between diversity and management and legume presence (or abundance, it is unclear) and management.

This experiment addresses fundamental mechanisms of the biodiversity/productivity

relationship, conservation issues, and some very general applications for grassland managers. I found the framing questions presented at the end of the introduction to be compelling and a great focus for the paper. I think the relation of results to these questions and their background could be clearer. I also found the presentation of the data analysis in the paper to be confusing at times.

Specific comments

Due to obvious logistical constraints, the experiment has not tested all possible diversity levels and all potential management strategies. Because of this, I think it is important to acknowledge that your results apply to the range and type of management in the experiment and that you are not able to say something about the difference between management and biodiversity overall in their affect on productivity. If the relevant justification was given for the choice of management intensities and diversity levels, a claim could be made about the differences between common management practices and the ease of maintaining these high diversity levels.

One prominent issue in diversity experiments like this one is the sampling effect. One of the proposed solutions is to make sure that all of the species present in the high diversity plots are represented in monoculture. Of course, if this is not the case, it can be assumed that by picking the most productive species in a diverse mixture and growing it in monoculture would produce higher yields. To implement this design in this experiment would be very difficult due to the large species pool. I do think that a reference to the problem and the experiments that have rejected the sampling effect would be a useful addition to the paper.

I think the introductory and discussion treatment of framing question #2 (the affect of management on the slope of the diversity, productivity relationship) could be expanded.

Results show that the most productive plots are those both intensely managed and with high diversity. However, there is an unseen cost here of the increased labor and resources required to manage a land. Mentioning this issue and any analysis you might

be able to do would improve the depth and relevance of the paper.

The presentation of the analysis could be improved. It took me some time to work out table 2. The definitions of the different models should be rewritten in the caption for easy reference. I was confused by the splitting of these models throughout the table. Table 2 is simply too large (and subdivided) to refer to it in the text only as Table 2. You may even want to consider labeling the significance tests in the table that are discussed in the text as a, b, c, d, etc.

Technical corrections

You switch between the English and American spelling for a few words: fertilize, italicize, practice and related words have both British and American spellings present.

Page 3191 Line 14. It is unclear from the methods whether functional group richness was "manipulated". How is the gradient achieved? Is it an effect of random sampling of species richness (FG not directly manipulated) or is it an imposed gradient with random sampling to satisfy it (FG directly manipulated)?

Line 17 – 18 This sentence seems to be missing something or has an extra word.

Page 3192 Line 4-5 Stated like this, the sentence implies that statistics support the solution to the problem. If so, provide those here. If not, merely state that the design was an effort to deal with the heterogeneity in the field.

Line 13 Why are the mixture created by random selection with replacement? Do you have 16 species mixtures with less than 16 species? Also, randomly selecting species does not yield the number of replicates you have for 1, 2, 4, 8, and 16 species mixtures. This must be the input to the randomization, not the product. This explanation is confusing and poorly worded. Also, a consideration of the weighting of species abundances is missing. Were equal weights of seeds used or was a back calculation made to produce equal final total biomass?

page 3193 Lines 11-14 These sentences are confusing. In these lines believe you

mean to say that everything was fertilized once aside from the management treatments. And then, there are 4 management treatments and one control, added with the 78 plot diversity setup gives 5*78 = 390 total data points.

Line 19 This design could be validated if you provide statistics that the subplot assignment of the other treatments had no statistical effect the primary measurements (overall productivity).

Page 3195 Line 18 - 20. The sentence seems redundant within itself.

Page 3195 Line 5 "Increasing species richness significantly increased..." Because of the complications with the sampling effect and other logistical realities I think this statement is somewhat misleading to the reader. A more accurate phrasing might be, "Plots with higher species richness had significantly greater..." Line 10 Same thing with functional group richness.

Page 3198 Lines 21-23 This is stated with broader application than the experiment warrants. The diversity treatments imposed were more effective than the management intensities imposed. I also don't understand why you are comparing the highest diversity to the highest management intensity and not the most productive level of management intensity.

Page 3199 Lines 15 – 25

This paragraph was confusing to me. It should be clearer that you are talking about these multifunctional grasslands where all biomass is good biomass and why you are comparing it to a hay field, where hay biomass is the goal.

Page 3200 Line 24 This pattern is difficult to read from the graphs. Statistics on the difference in slope should back up this statement.

Page 3201 – 3202 The biofuels literature was mentioned in the introduction, and I think this section of the conclusion could benefit from some reference to this work and how these results fit in with the goals and research in biofuels.

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