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Biogeosciences Discussions

Interactive comment on "Interacting effects of vegetation components and water table on methane dynamics in a boreal fen" *by* Terhi Riutta et al.

Anonymous Referee #2

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This manuscript presents results for methane (CH4) flux from a water table drawdown and vegetation removal study conducted in an oligotrophic fen. All plots were studied for one year prior to any treatments and then the effects of water table lowering and vegetation removal were studied for the following three growing seasons. The authors observed that water table drawdown greatly reduced CH4 flux. In the first two years after treatment, vegetation removal plots often had higher fluxes than intact plots. By year three, plots with removal of dwarf shrubs continued to have higher fluxes than intact plots while plots with removal of shrubs and sedges or shrubs, sedges and Sphagnum had lower fluxes. Differences between vegetation treatments were only significant under wet conditions and not when the water table was lowered.

Overall, this study adds to our understanding of the interactions between water table and the presence of plant functional types on peatland CH4 emissions. However, I do think that the authors could add to the introduction and data analysis to better highlight how this paper moves beyond what we already know based on many of the studies they reference in this manuscript. In particular, I suggest that the authors add specific objectives, and possibly hypotheses, to better highlight the knowledge gap they aim to fill and how their study is unique in doing this. I also suggest that they consider the specific role of sedges more explicitly, potentially with a regression analysis between CH4 flux and sedge LAI, with interaction with water table. Some additional minor suggestions and further details on these revisions are given below.

Abstract: Just check the superscripts on the CH4 units and correct where necessary

Lines 27-28: Wetlands are the largest natural source of CH4, but much of this is from marshes, so I suggest adjusting this sentence. Also Saunois et al. 2016 is probably a better reference here than many that are given. Finally, I believe the correct reference for the first in the list is Mikaloff Fletcher et al. 2004, not Fletcher et al. 2004

Line 27: Here you use CH4, but later go back to using methane. I suggest you actually define CH4 here (so say methane (CH4)) and then use CH4 throughout the remainder of the manuscript.

Line 56: But what about trees? There is evidence they vent methane despite being shallow-rooted.

Line 69: "Fewer the roots" can just be "Fewer roots"

Lines 72-74: The introduction ends rather abruptly here and left me fairly unexcited about the study. I suggest that the authors could do a better job of highlighting the specific gap they are addressing here. Maybe also adding specific objectives and hypotheses would also help to transition to the methods here.

Line 194: There are two sentence here. Add a period or a connecting word.

Lines 199-200: Do you have data to show or a reference to another study to support this statement?

Lines 199-209: The differences between the years and the link to effects of plant removal and then stabilization seem to be largely conjecture. I agree that this makes sense, but without data to directly support how subsurface inputs were varying, and since weather and WT also varied between the years, I feel that some of the statements in these paragraphs are too definitive. I like how the changing patterns of fluxes are described, but unless there are direct observations to support "stabilization" in 2004, I'd suggest keeping the treatment effects for the discussion.

Line 229: Did you look at this pattern when the mean at each plot is considered? Since you have taken an average of all the plots for each treatment, this is not too different than looking at differences between plant removal treatments (e.g., Figure 3). Since you have so many replicates for each treatment type, it would be really nice to see how this relationship looks if each plot is a point on the graph in Figure 4. This could also help to illustrate the effect of PSCD being lower than the pattern driven by the other plots, which is currently a tough sell with only 4 points on the line for each water table treatment.

Lines 238-239: How did sedge cover differences in response to shrub removal affect the CH4 flux patterns? It would actually be interesting in general to see whether there was a correlation between sedge cover and CH4 flux when looking across all plots and whether there is an interaction with water table, particularly as this is alluded to in the introduction when reporting results of previous studies. I think this could be a really nice addition to the results and then could support this point made here.

Lines 268-284: Do you have any information from other studies at this study site to support this section. Even data on root distribution of the different species would help add confidence to this discussion.

Figure 2: I understand that the scale on the axes are kept the same on the top and

bottom row of plots so that they can be easily compared, but since the effect of water table drawdown on CH4 flux is already clearly shown in Figure 1 and the goal of this figure is to highlight vegetation effects, I suggest altering the scale on the bottom row so that variation between vegetation treatments can be seen. Since the fluxes are quite low post-water table drawdown, nothing can really be seen in this figure the way it is currently drawn. I would just point out the difference in axes in the caption and possibly even direct the reader back to Figure 1 for a clear comparison of control vs. water table drawdown fluxes.

Reference: Saunois M. et al. 2016. The global methane budget 2000 - 2012. Earth System Science Data, 8, 697-751.

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