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Comment

Interactive comment on “Agricultural peat lands; towards a greenhouse gas sink – a synthesis of a Dutch landscape study” by A. P. Schrier-Uijl et al.

A. P. Schrier-Uijl et al.

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Received and published: 17 September 2013

Dear referee 2

Thank you for the very useful comments. Myself and my co-authors have tried to answer all of your questions and we have implemented the suggestions you have given us, which has greatly improved our publication. Since both referees mentioned the incompleteness of the materials and methods section, we have tried to, as short as possible, add all information you have asked for, while in the meanwhile we have referred to publications that previously have used similar methods. Please find below a more specific overview of what we have changed according to your comments.

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synthesis of a Dutch landscape study” by A. P. Schrier-Uijl et al.

Anonymous Referee #2

General comments This article discusses the impact of land management and changes to land management on greenhouse gas fluxes from peatlands in The Netherlands. The topic of the paper is of relevance to Biogeosciences and will be of interest to an audience interested in mitigating greenhouse gas emissions from land use and land use change in peatland environments. The paper reports greenhouse gas and other carbon fluxes from three sites under different land use intensity over a four year period. Estimates of the carbon and greenhouse gas budgets are estimated and compared for the three sites. The resulting values are used to estimate emissions at regional scale. The paper extends previously published results and provides a synthesis and comparison of results obtained at the three peatland sites. Although the results of the study are of interest, the paper draws too heavily on previously published work conducted at the same research sites. In particular, the methods used to measure the carbon and greenhouse gas fluxes are not described in sufficient detail (we agree, and we have now totally rewritten the section on materials and methods, specifically section 2.3, 2.4 and 2.5; we have added all specific information you have asked for, and we have tried to avoid referring to other papers as much as possible). Specific comments Page 9702, line 24 to page 9703, line 2. Were similar or identical measurement procedures used for the three sites? We have added descriptions of measurement procedures for the three sites, including information of the instruments we have used. If different methods were used then explain what measurement procedures were used at each of the three sites. OK. Provide details of how data were post-processed and quality controlled: What software package (or packages) was used to process the fluxes? Which corrections were applied to arrive at the fluxes? How was quality of the flux data assessed/poor data excluded? What was the annual flux data coverage for each of the sites? How were gaps in the flux records filled to derive the annual sums? Perhaps include a measure of the quality

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of the eddy covariance measured fluxes (i.e. compare the energy balance closure for the three measurement sites). We have added information on what software has been used, what protocols we have followed (EUROFLUX protocol of Aubinet et al., 2000), what quality assessment, what gapfill procedures, what footprint models we have used, what the coverage of data was etc.. We have all given this in the new text of the materials and methods section. Page 9702, line 15 to page 9703, line 2. This section is somewhat weak in the description of the eddy covariance instrumentation. The reader would need to read a number of other publications reporting measurements made at these sites in order to find out the full details of what sensors were used and how they were set up. Include full details of the measurement systems at each site (perhaps using a table for direct comparison of the systems used between the three sites if there were differences in the types of instruments used) OK. We decided to add this information in the text since in most cases the instrumentation of the three sites was the same. Make it clear if there were any specific differences in the eddy covariance systems/data handling procedures used at each of the sites. OK, done. For example, were the same models of sonic anemometer and gas analysers used at all of these three sites? We have added this information in the text. Page 9703, lines 10 to 11: Add a short explanation on how you got from these chamber concentration measurements to the flux values. Explain why this particular measurement protocol was selected and used for these peatland sites? We have rewritten the section on small scale chamber measurements, and we have added more explanation on how we got the final fluxes from concentration measurements. We have used the protocols that had been described for the three sites in previous publications (results have been cross checked with EC data). Page 9701, line 13; Page 9701, lines 23 to 24; Page 9702, lines 9 to 10. As hydrological regulation is one of the major differences in the management of these peatland sites, it would be good to see plots of the dynamic water levels for the different seasons and years. Perhaps consider showing the variation in water levels in a way that allows for overall comparison between the different sites and years? We have created a new figure that shows monthly averages

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for water table and soil temperature in Oukoop (Ou), Stein (St) and Horstermeer (Ho) for the four years of measurements. Page 9703, lines 10 to 14: Provide additional details on how this was done and what relations were used? OK. We have added this in the text. Were the same methods used for both CO₂ and CH₄ fluxes? We have added information on this in the text. Provide details on the non-linear functions and weighting factors used for this. OK Page 9703, line 23 to 9704, line 7. As above, more detail on these measurement systems is required here. What sonic anemometers were used at these sites? Provide model numbers for sonic anemometers and gas analysers. How were the EC systems set up? Add details of the orientation of sonic anemometers and IRGAS, instrument separation distances, etc. What was the sampling rate of the raw eddy covariance measurements? Although this information may be available in the previously published articles, these are important details of the research presented in this paper and should be included. Comment on any differences in the instrumentation used at the three sites. OK. We have added short descriptions of all information you are asking for. It is true that it is all described in other publications already, but we agree that it is more clear to briefly repeat the main issues (that you are mentioning) must be added for clarity. Page 9704, lines 6 to 7. Consider adding the details of these additional micrometeorological measurements as a table for summary and comparison? We have decided to bring this extra information in the text (since we have already a lot of tabs and figs). Page 9704, lines 9 to 27. In general, this section is lacking in detail. Consider revising to include more comprehensive details of how these supporting measurements were obtained. Perhaps split this paragraph into two sections, one on the supporting meteorological and soil physics section (OK, we have done that. We splitted up in two paragraphs, one on meteorological measurements and soil measurements and the other on analysis of data), and one on the analysis of the soil properties. For each of these sections provide more detail on all of the supporting sensors used and how these sensors were installed (i.e. with what instrument did you measure air temperature and humidity, and at what height above the surface was this measurement taken?). Add a summary of how the soil

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and water samples were treated and/or add completely "unmanaged" as has been the term used to describe the site throughout the manuscript. Consider revising this term to something like "restoration site" or "former agricultural site". OK. We have added the information you are asking for. WE also have changes the term 'under restoration' in 'unmanaged' or 'restored'. There has not been any management since it has been abandoned. The water table is being modified (as in the largest part of the Netherlands, the land is below sea level). Page 9712, line 21 to 27. This data on the presence/absence of diurnal cycles of the CH₄ fluxes was not presented in the results section of this paper. Introducing this here does not seem overly relevant to the aims of the present study which is primarily focused on producing estimates of the GHG budgets of these sites. Recommend that this is either omitted from this discussion, or that consideration is given to this in the previous sections. You are right. This does not add anything to the discussion in this paper. We have decided to indeed delete this part. Page 9713, lines 4 to 9. As above, this statement appears at odds with the definition of the Horstermeer site as being unmanaged. Consider revising the "unmanaged" terminology used for this site. OK. See comment above. Page 9714, lines 20 to 22. As above, if the water levels have been raised from previous levels, then this does not imply that this is a zero-management site. Perhaps consider revising this to reflect the situation that the hydrology of the site is managed but that there is a lack of direct vegetation management, or something similar? We have changed the term 'under restoration' in 'unmanaged' or 'restored'. There has not been any land management since the Horstermeer polder has been abandoned. The water table is being modified, however, the WT is being modified in the largest part of the Netherlands, the land is below sea level (see also introduction paragraph). So, we have rewritten the text slightly, for example, we have changed 'management' in 'land management'. Page 9716, lines 25 to 26. What is meant by inverse drainage systems in this sense? This sentence was unclear, so we have deleted this part. We have just mentioned that it is important to keep the water table at all locations at a certain distance to the soil surface. Add a short section of text explaining what is meant by this

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in this context. Page 9716, lines 26 to 27. Add more explanation of why this reduction in the overall sink strength might be expected. OK. Done. Technical comments Page 9697. In the main body of the manuscript you use “peatland”, but in the title “peat lands” is used. Be consistent throughout the paper. OK. Page 9697, Line 2. Reduction of management is a bit of a vague term here. Perhaps change to: reduction of the intensity of land management? OK Page 9698, Line 1. What does this refer to? Be specific: the total Earth surface, or the terrestrial surface of the Earth. OK. Page 9699, line 19. Consider changing to. “..are now classified as...” or something Similar OK Page 9700, line 5. Be more specific, consider changing to... “intensively managed peatlands in the Netherlands” or something similar. OK Page 9700, lines: 24 to 25. What is a moderate climate? This sounds a bit vague in this context and should be more specific OK, specified. Mean annual temperature and rainfall over what time period? OK. We have explained this Page 9700, line 25: Consider changing “All sites” to “The peat soils at all sites” or something similar? OK Page 9702, lines 15 to 16. Consider revising this sentence: i.e. “the measurement of CO2 fluxes between 2004 and 2008” or something similar. OK Page 9705, lines 19 to 21. Complete sentence with a comment to justify why this considered negligible. OK Page 9705, lines 24 to 26. Similar peat soils in the same study region, in The Netherlands or elsewhere? Have added this information. Page 9706, lines 6 to 14. Add details on the numbers of cattle in each of the categories listed (perhaps these numbers should be added to the Results section?) OK. Done. Page 9709, lines 2 to 7. Perhaps add some values for the cumulative annual CH4 balances and the maximum summer time CH4 values to the text? OK. Page 9709, line 27. Typographical error. Change “al” to “all”. OK Page 9710, line 15. Be consistent in the use of "Nitrous oxide" and "N2O". OK. Page 9710, line 20. Change warming potential to global warming potential or GWP? Done. Page 9712, line 2 (and other parts of the manuscript). Change "CO2 NEE" to "NEE". Done. Page 9712, line 18. Change “to” to “towards”? OK. Page 9715, section 4.2. Consider moving this section to Results? We have moved this section to the results as it belongs there indeed. Table 1. Add information on the range of water level variation

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observed at the sites during the study period. We have added Fig 1 on this. Table 3. Include the SD with the mean values in the final column. Consider changing the column label from average to mean? OK. Table 6. Add an additional column showing results in global warming potential? Figure 3. This figure is not well labelled. Consider adding months of the year to the x-axis of the lowermost row of plots in this figure OK, we have done that. Label the three rows of plots (i.e. by site name, or using a, b, c, or similar) and include these details in the caption. Also, there appear to be some large daily NEE values during the early period of 2005 at the Horstermeer site that are not evident in subsequent years or at the other measurement sites. Include an explanation for these large early season CO₂ fluxes in the main text. Figure 4. Consider changing the x-axis labels to indicate months rather than numbers. Perhaps add some shading to the figure to indicate the different years. Change “CO₂ NEE” to “NEE” (also in the rest of the manuscript). Change the figure caption to make it clearer that these are averages of daily NEE calculated for each month. Are the units of this figure and Fig. 4 the same? Consider showing the partitioned estimates of GPP and Reco in this plot (and also in the text). We have discussed this, and we have revised figure 4 according your comments. Figure 5. Make x-axis labels easier to read. For example, perhaps use DOY for each year and indicate each of the years, or perhaps use months of the year. Consider using the same units and labelling conventions across all figures. For example, at present some results are presented in square meters and some are in hectares. Use the same font sizes on all figures

Please also note the supplement to this comment:

<http://www.biogeosciences-discuss.net/10/C5096/2013/bgd-10-C5096-2013-supplement.pdf>

Interactive comment on Biogeosciences Discuss., 10, 9697, 2013.

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