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Biogeosciences Discussions

Interactive comment on "Annual carbon balance of a peatland 10 yr following restoration" *by* M. Strack and Y. C. A. Zuback

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We thank the reviewer for their insightful questions and comments. We have broken down the comment into sections and respond to each below. Reviewer comment is given first with our response following.

1. The study includes data from only one year. Having done field work myself I know that it is hard to get multi-annual data but I hope the team will be able to continue the measurements.

We agree that it is unfortunate that data are only for one year, particularly since the study summer was so dry. However, as it is a comparative study between restored, unrestored and natural peatland sites, we feel that the results are valuable for under-

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standing the impact of restoration on the carbon balance in comparison with unrestored peatlands, although multi-year data would be needed for confidence in the absolute carbon balance magnitude. We have recently received funding to study these sites for five years starting in 2013 using both eddy covariance and chambers fluxes, so there will be more to this story in several years time.

2. I do not agree with the last sentence of the abstract, that because the restored site acted as a smaller source of carbon than the natural peatland this suggests that a near natural carbon balance can be returned _10 year post-restoration. The year when the measurements were taken was slightly warmer and drier than the 30-year average. Previous studies showed high inter-annual variability of a peatland carbon balance and therefore I would be cautious to draw general conclusions after one year.

As both reviewers felt that this statement was too strong, we suggest that it is changed to a more general statement about the carbon balance. We will rewrite the sentence to read "These results suggest that, although the hydrological processes and rates of CH4 efflux from the restored site are still intermediate between an unrestored and natural system, peatland restoration resulted in a large reduction in annual carbon loss from the system resulting in a carbon balance more similar to the natural peatland."

3. Using the chamber technique with manual measurements is not state of the art anymore but I understand that in some environments it might be the only possible way of taking measurements.

We would argue that when trying to develop process based understanding of controls on carbon fluxes following restoration, chamber measurements may be the most appropriate scale.

4. Were any tests made with taking more than 4 samples in order to see if fluxes increase exponential rather than linear during chamber deployment? For CH4 flux, only four samples were collected, but all CO2 fluxes are based on at least 7 measurements. In general we do not see evidence of exponential changes in concentration over the

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chamber deployment likely because vegetation cover is still relatively low and chamber closure times we less than 2 minutes.

5. As I understand the presented CO2 and CH4 flux are the mean of all sample plots which were placed to represent the different vegetation cover and microtopography at each site. From Figure 2 and 5 it seems that net ecosystem exchange (NEE) and CH4 flux are more variable in the restored site compared to the natural site. Are fluxes very different between the different plots in the field for each site or is the spread mainly coming from different days of measurements?

It is both. The restored site had more variability between plots and more variability between sampling dates. This is due to the developing vegetation community and recovering hydrology at the site. Because of the very distinct layering between the new peat and the underlying highly decomposed peat the water table is more variable over time at the restored site and this adds to the variability.

6. It would be interesting to upscale NEE and CH4 taking into account the vegetation distribution of the three sites.

Although the vegetation cover is heterogeneous at the site, it is poorly structured resulting in a pattern of more or less density of the same species covering the site. We tried to capture vegetation variability with our chamber locations, but it was not possible to really define distinct communities to target for which a specific carbon flux could be attributed for upscaling. Instead we tried to distribute the locations across the site and the hydrological gradients that existed and we did try upscaling the results by spatially interpolating between the sample locations. However, the resulting flux was not statistically different from a mean. Given the uncertainty in upscaling without a high density of values (and the difficulty in obtaining a high density of carbon flux measurements) we chose to present the mean and range to give the reader an understanding of the variability that exists. There is, however, a very clear difference in hydrology, vegetation community and resulting fluxes between the peat fields, ditches and open water pools

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and so these were weighted separately in the final table.

Interactive comment on Biogeosciences Discuss., 9, 17203, 2012.