

***Interactive comment on* “Environmental controls of greenhouse gas release in a restoring peatbog in NW Germany” by S. Glatzel et al.**

S. Glatzel et al.

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We appreciate the thoughtful comments by referee#1 and hope that we are able to properly address all the raised issues. We deleted some passages that disturbed what this contribution should be focused on according to the wishes of both referees. Most importantly, we deleted the last paragraph of the conclusion and inserted the following passage instead: Another goal of peatland restoration is the net reduction of the release of CO₂ equivalents. This contribution shows that under conditions of high rates of atmospheric N deposition it is important to avoid frequent water table fluctuations that may increase N₂O release. Especially in periods when NO₃ uptake by vegetation is not strong (late autumn to early spring), a high water table must be maintained. At this point, we are not able to judge for how long a water table drawdown with subsequent restoration of high water table will decrease CH₄ release. A very low water

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table may decrease CH₄ and CO₂ efflux, but likely damages peat forming vegetation (Glatzel et al., 2006) and may favor growth of species adapted to a fluctuating water table as *Molinia caerulea*. For this reason, our present state of knowledge suggests that the reduction of the net release of CO₂ equivalents in N loaded temperate peatlands depends on a high water table. This passage addresses the most important issues to consider (water table management and feedbacks between water table fluctuations and vegetation). At this point, we are not (yet) able to present a recipe for climate friendly bog restoration. We added specific statements on the role of experiments to support the hypotheses as well as on the criteria of confirmation or falsification of the hypotheses in chapters 2.3 and 2.5. We now describe the measurement routines more closely. We also now comment on the use of boardwalks (which was not possible due the conservation status of the site) and the inclusion of headspace temperature for gas flux calculation (Chapter 2.2). We inserted a short passage in chapter 3.4, stating that the CO₂ evolution pattern was consistent throughout the incubation period. We now included *n* in the caption of Figure 3. In the sense suggested by referee#1, any examination on a temporal course of gas efflux is amount to a temporal pseudoreplication. Referee#2 specifically asked for a graph and a regression based on temporal pseudoreplication. It is a common and helpful practice in ecological research to analyze the temporal course of ecological parameters the way we present it here. For this reason, and referring to Hargrove and Pickering (1992), we think that by mentioning *n*, and keeping in mind the issue of temporal pseudoreplication, the reader should be able to assess the value of Fig. 3. It is correct that *Calluna* hummock and *Sphagnum* hollow are not peat types, so we deleted this inaccurate description. However, the idea of this passage is the statement that CO₂ release did not differ between treatments (fertilized vs. unfertilized) due to differing sampling depth and peat type. As peat type was not examined (e.g. no macrofossil analysis had been conducted), we are not able to describe the peat samples more accurately, so we change the expression to peat properties. From analyses on peat C and N content, we know that the properties differed, so this expression should be justified. The view on CH₄ emission (not considering

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the CH₄ conduit function of aerenchymatic vasculars) is not that simplistic, considering the first paragraph of chapter 4.1, where exactly the issue of aerenchymatic vasculars is discussed. We now also mention this important perspective in the (shortened) discussion of the von Post humification index. We changed anerobic to anoxic in the appropriate passage. Fig. 2 and its caption refer to the mean of 14 measurements from four (hollow) or 6 (hummock) locations. This is the reason for the small n (and low power of the test). We also corrected the editorial comments as well as some additional editorial comments that had, up to now, not been noticed by anyone. The most important improvement is the correction of the faulty unit milligram by the correct unit microgram in Figure 7.

References: Glatzel, S., Lemke, S., Gerold, G.: Short-term effects of an exceptionally hot and dry summer on decomposition in a restoring temperate bog, *Eur. J. Soil Biol.*, 42, 21-22, 2006. Hargrove, W.W. and Pickering, J.: Pseudoreplication: a sine qua non for regional ecology. *Landscape Ecol.*, 6, 4, 251-258, 1992.

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