Here Bethe et al. works a relevant knowledge gap about the effects of the topsoil removal (TSR) without rewetting. The previous literature has primarily considered couples of TSR with rewetting, so the decoupling these two management interventions is an interesting contribution to peatland management literature. The model formulation appears suitable, as it includes an exponential temperature response and the parabolic soil moisture term. But, in my point of view, the most original idea of the manuscript is the approach used to collapse the carbon profile and groundwater level into a single metric (section 2.5). This is a well done calculation to integrate these two variables. Besides, the combination of the counterfactual decomposition with the SHAP to partition the differences between regenerative ditch borders (RDBs) and conventional borders (CDBs) and to assess their contributions from a spatiotemporal analysis. I found very strength part of the study. I also appreciate that the manuscript is cautious in their analysis of trade offs, by not oversell the 17% of reduction by RBDs compared to the CBDs. So I hope my comments below can help the authors to improve the manuscript.

We thank the reviewer their time in reading and reviewing our manuscript and for the prompt and thoughtful feedback on our submission. We are very pleased to see the positive responses and are grateful for the opportunity to make improvements based on the suggestions received.

There is a problem in the experimental design, and consequently the level of the general conclusion. There are only 4 CDBs and 16 RBDs and all of them located within a single minerotrophic peat polder. So, talk about the Dutch peat meadows appear to be extended considerably beyond the site replication, so how do the authors can justify this broader inference based on a single ecosystem site?

We recognize that our results are based on measurements from one peat polder. Generalization of our results is a next step and we will emphasis this more in the discussion by comparing our conclusions with Aben et al. (2024), in which estimates of carbon balances from other Dutch peat polders are presented. Briefly, our calculated annual modelled soil respiration are comparable giving us some confidence in our calculations and suggesting that our study system is not unrepresentative of the broader peat meadow agroecosystem. However, we have no other comparable studies of ditch border management effects to compare our results too. Expansion of our study to more locations would be needed to confirm our conclusions. We will add text covering these points to the Discussion.

I am also concerned about the apparent use the same data both to fit the model and generate the observed respiration, so it is feeding and payback the model, please consider it in the analysis as circularity validation. Please try to clarify wheter an independent validation of the data, cross validation, or another type of validation.

We appreciate the reviewer's careful reading of the method section, however this part of the methods was interpreted differently than intended. We don't generate observed respiration rates. The observed respiration rates were measured in the field: "five times throughout the period between June 2023 and March 2024 (June-August-October-January-February/March) at each distance at the water's edge across all DBs. Additionally, we measured soil respiration more frequently at a subset of the DBs (2 CDBs and 4 RDBs in July-September-December) to ensure we captured adequate seasonal variation in soil respiration". (see lines: 239-256). The model was based on these measured/observed respiration rates. The model was then used to interpolate unobserved time periods to calculate an annual modelled soil respiration and, subsequently, estimate the payback time. We hope this clarifies the concern.

I am surprised that the daytime chamber campaigns missed April-May months, these months represent an important transition period in temperature dynamics, where ambient temperature increase rapidly and respiration rates change substantially, what is the reason for omitting them? But also, you need to acknowledge that your study is made from daytime and it is missing the diel effects, so in this context 17% of differences between RDBs and CDBs should be interpreted with caution.

We recognize that these are important months, however due to site access limitations during the meadow bird breeding season it was not possible to measure in these months. Our solution was to use the model fitted to the data from the remaining months to extrapolate over this missing period when calculating our annual modelled soil respiration. Likewise, our estimates of total annual soil respiration are based on daytime measurements which could possibly lead to overestimation of total daily respiration. However, we have no reason to believe this bias will not affect our estimates of the relative difference in respiration between CDBs and RDBs. We agree that it is important to describe this assumption clearly and will incorporate this into the Discussion (in the section to lines 729-740 in initial submission). As noted in the response to a comment above, our estimates of annual soil respiration also compared well with corresponding estimates from other Dutch peatlands based on much higher frequency respiration measurements using automated chambers (Aben et al., 2024). We will include this comparison, but also emphasize that some caution is needed in the interpretation of our annual soil respiration estimates, as they are based on daytime measurements.

Regarding the carbon-debt calculation and propagation of uncertainty, I can see that extrapolations came from a single point and carbon density were measured at only one site nd then extrapolated for other sites (40, 80 ad 640 cm), so the extrapolation errors are absent for the reported uncertainties. This is particularly important because the

excavated carbon term appears to be a major factor controlling the estimated carbon payback time. If the underlying c density estimates are derived from a single sampling point, their extrapolation across the entire excavated volume may introduce substantial uncertainty and potential bias.

This issue was also raised by the other reviewer so we will include our response here:

We understand the reviewers concern in regards to our exposed carbon calculation method. We have two points in response 1) during the fieldwork, we took additional soil cores along and adjacent to the transect with a smaller diameter gouge auger to check whether there was significant variation in peat profiles on small horizontal spatial scales. We did not detect large discrepancies in the sequence of layers or their depths along the transect points compared to the main sampling core used for our extrapolations. This consistency of the peat profiles within a transect, together with laboratory constraints were the reason for collecting and analyzing only one core for each ditch border. 2) The reviewer correctly notes the large variation in peat profiles between ditch borders, but it should be noted that these are separated on the scale of 100s of meters and are located in different fields. This variation is relevant for the overall variation in our observations and conclusions, but not we would argue for judging the validity of our extrapolation procedure to estimate C content within a transect. Nevertheless, we agree with the reviewer that unmeasured variation in C content within a transect will have introduced an unknown amount of additional error in our estimates. However, in the absence of reliable quantitative data of small-scale soil carbon heterogeneity at our site, we believe it would be misleading to attempt to formally estimate the magnitude of this uncertainty. In the revised version we will add a discussion of this issue (and others raised by reviewer 2) by pointing out the potential risks of bias and explicitly highlighting the additional uncertainty introduced by the extrapolation steps in our analysis.

Aben, R. C. H., Van De Craats, D., Boonman, J., Peeters, S. H., Vriend, B., Boonman, C. C. F., Van Der Velde, Y., Erkens, G., & Van Den Berg, M. (2024). CO2 emissions of drained coastal peatlands in the Netherlands and potential emission reduction by water infiltration systems. *Biogeosciences*, *21*(18), 4099–4118. https://doi.org/10.5194/BG-21-4099-2024