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Interactive comment on “The significance of organic carbon and nutrient export from peatland-dominated landscapes subject to disturbance” by S. Waldron et al.

Anonymous Referee #2

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The significance of organic carbon and nutrient export from peatland-dominated landscapes subject to disturbance S. Waldron et al.

I believe this manuscript could be suitable for publication in Biogeosciences, as it falls within the remit of original papers for the journal. The main aims of this work were to establish how aquatic C, N and P species will be affected by an upstream windfarm development. Allied to this, stoichiometric ratios have been applied to determine potential maximum production of CO₂ from the DOC/POC within the stream itself.

However, I have some comments with regard to focussing the manuscript to establish the main points of the work and at times found the language could be improved for

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conciseness, clarity and precision of the work. Overall, the individual sections could be better signposted to express each of their main points more clearly.

The sampling protocol at Whitelee, in particular for POC, which is particularly important in disturbed catchments, must be taken as only a basic estimate of potential carbon losses from the catchments under investigation as 8220;one sample approximately every 3 weeks8221; will underestimate this flux and is not bimonthly, particularly as hydrological events were not targeted. Therefore, the interpretation of the budget/flux data should be viewed with this in mind. It might be better to remove this section reliant on budgets and focus the paper on stoichiometry relationships and affects of disturbance on these parameters.

Abstract:

The abstract could be more concise and for clarity state that this work is about a comparison between disturbed and non-disturbed peatlands and that at Whitelee, it is off-site receiving waters that the study is taken from pre and post disturbance. The 14C measurements described in the abstract are not actually part of this work but more a discussion point and should be removed from the abstract.

Introduction:

A concise introduction could be rearranged in order that the literature leads to the aims more fluently. For clarity, the 3rd aim of the paper (budgets for carbon export) needs to be stated more clearly in the introduction to match the 3 aims described in the discussion section.

P1141, Line 10: The general proportions of sources of CO₂ in headwater streams should be stated here, Majority of the CO₂ in upland peatland streams is derived from the soil pore waters prior to entering the stream resulting in oversaturation and is then connected with the atmosphere through degassing. Although in stream processing of DOC to CO₂ does occur in these environments, what are the proportions of het-

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erotropic respiration to uv oxidation?

P1141, Line 24: From the site area details later on, Glen Dye does undergo major land management practices (heather strip burning for grouse, sheep grazing) but could be considered a less disturbed environment.

Methods:

I found the methodology generally well written but overlong in places and feel that this section could be reduced without lowering the impact and understanding of how the work was carried out. With a more extensive use of references, particularly in the site description, this section could be reduced to concentrate on the more important parts relevant to the present study.

P1144, Line 11: How long was the period of collection prior to disturbance? What are the disturbance dates? How far downstream were the sampling sites from the actual development?

P1144, Line 20: As stated earlier this sampling protocol is a major limitation on POC measurements. What was the sampling frequency at Glen Dye?

P1144, Line 22: This section is results and the discussion of limitation of light penetration is important in terms of the limited UV oxidation that might be occurring.

P1145, Line 30: Particulate load is described as low, what are this actual value? Moreover, in the Water of Charr catchment (upstream from the 41.7 km² Water of Dye site), the particulate load is substantially higher than other parts of Glen Dye due to eroded areas in the upper part of its catchment. Due to deposition in the main channel, this higher POC might not be observed at the Water of Dye. This spatial variation is an important consideration at the Whitelee catchment, as much of the POC generated could have been deposited, resuspended or undergone decomposition to DOC and CO₂ in the stream prior to reaching the outflow measurement sites.

P1146, Line 10: Were all samples treated the same and acidified to pH 4 to remove

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both bicarbonate and carbonate from the samples, thus following rotary evaporation CO₂ is lost, hence removing all inorganic carbon?

P1146, Line 17: Is there a reference for assuming 60

P1147, Line 18: Why mention the limit of detection for nitrite when the data is not presented in this paper?

P1147, Line 21: for the nutrient analyses of Glen Dye waters, is there any data on the accuracy on reconstituting freeze-dried material and could you explain more clearly how you checked for the accuracy of the nutrient data ie by using subsequent samples with the same DOC at the same time of year etc.

Results:

I think the results section in the main could be set out more clearly and concisely with subheadings related to each methodology section. Moreover, there are sections of the results section which could be more usefully described in the discussion section, e.g., P1149, Lines 3-8; P1151, Lines 3-18). Nitrate is NO₃⁻ not NO₃²⁻.

P1150, Line 16: explanation of inverse correlation not really required.

P1150, Line 12: what value of primary production is considered insignificant? Even in upland headwaters of Glen Dye, PP exists and can be determined.

P1150, Line 14: Could you explain further in the discussion what microbial and bacterial stoichiometric requirements actually are in comparison to the results obtained.

Discussion:

I think the discussion is overlong and not easy to follow without breaking it up into sub-headings relating to the main methodology and aims of the paper. Parts of the discussion would also fit better in the introduction e.g. P1155, Lines 14-24; P1156, Lines 27-29 and P1157, Lines 1-10 to place the work in context.

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P1153, Line 10: Temporal variation in the CO₂ efflux in these catchments is also influenced by the soil pore water CO₂ inputs. This should be stated as being the initial control on CO₂ in the stream waters. Temperature also controls CO₂ efflux both in terms of soil production of CO₂ and CO₂ water solubility and hence atmospheric equilibrium and efflux.

P1157, Line 27: As much of the DOC is clearly allochthonous in origin, it is even more reason to discuss the influence of soil-derived carbon, (DOC and CO₂) rather than just in-stream production of these carbon species.

P1159, Lines 17: This should describe the maximum proportion of organic carbon that could be available for respiration and end up in the atmosphere or remain as organic carbon to the ocean. How does this take into account further continual inputs from soil waters? What is the CO₂ equilibria? is it with atmosphere or with the bicarbonate/carbonate ions? either way requires pH and temperature.

Conclusion:

Extensive, just need to concentrate on the main points allied to the aims of the paper.

References Waldron 2007 a and b are same paper.

Tables and Figures:

Table 1 is unnecessary and could be detailed in the text.

Figure 1: The area of each catchment is detailed already in Table 2. However, WL17 is 15.1 km² in Table 2 but 34.5 km² in Figure 1.

Figure 2: Is this necessary for this work as no relationship between discharge and parameters is discussed to in the text.

Figure 5: The N and S draining catchment legends should also be stated in this figure so that each figure stands alone.

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Figure 7: is not necessary and could be explained in the text that no strong relationship is shown between organic carbon loss and catchment size in this study. With regard to the legend, POC flux at Moorhouse is significantly large but also it is a heavily eroded peatland catchment. This should be discussed in terms of disturbance/erosion and POC concentrations in stream waters along with the impact at Whitelee.

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