

# ***Interactive comment on* “Soil profile connectivity can impact microbial substrate use, affecting how soil CO<sub>2</sub> effluxes are controlled by temperature” by Frances A. Podrebarac et al.**

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Here we provide the separate parts from the original review and in each case give our response following "Response:"

General comments The authors describe two soil incubation experiments, (1) of individual sub-horizons of boreal forest organic layers and (2) of entire organic layer profiles with their natural sequence from less to more degraded organic matter. Based on a comparison of these two treatments in two forest sites of different climate and at two incubation temperatures, the authors draw conclusions on the impact of exchange processes between shallower and deeper parts of the organic layer on carbon and ni-

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trogen cycling, in particular soil respiration. I find the study interesting and relevant and I agree with the authors that soil connectivity might have a strong (and understudied) effect on biogeochemical processes especially in the deeper soil. However, I have to admit that I cannot follow the argument in the discussion; this includes both difficulties understanding the meaning of the partly convoluted text and relating the interpretation to measured parameters. I recommend to carefully revise the discussion, refer to figures and tables throughout and consider an overview figure or scheme.

Response: Thank you for your careful consideration of this manuscript and these insights. We will revise taking care to clarify the main argument within the discussion through more explicit reference to the research findings. We agree that an overview figure – likely one that can be used to both highlight the original hypotheses and then help describe the resulting outcome of the study.

Specific comments Figures 3, 4, 5: The Q10 values seem oddly similar in the three figures and I can't align them with the temperature comparisons. Is it possible that you forgot to change this part of the figure moving from one to the other? Also, what do you mean with “cumulative respiration” in the legends of these figures (that are not about respiration)?

Response: The Q10 values are in fact the same values in each of the four cases (2 experimental treatments X 2 climate regions). They were provided this way to maintain that reference to the differences (or lack thereof) among horizons or treatments when looking at the soil chemical changes expressed in these 3 different figures. The Q10 values given in each figure refers to the temperature sensitivity of the cumulative respiration from across the whole experiment so matching with the time frame over which the change in soil C:N (Fig. 3), %N as THAA (Fig. 4), and Alkyl-C (Fig. 5) were observed in these soil incubations. Obviously, this was not clear so we will be sure to clarify both of these issues explicitly within the figure legend of each.

Sub-chapter 4.1: I have difficulties following this central argument. If you are referring

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to actual respiration data – are they shown anywhere in the manuscript or are they described in a previous publication? If they are in previous publications, would it be possible to show these data here (citing the original publications)? Or do you mean the mass loss data? Is the change in carbohydrates shown in Figure S4; and if Fig. S4 is central to the interpretation, why is it not in the main manuscript? It seems to me that you are describing an increase in both labile and complex substrate degradation by soil connectivity – but are they not measured relative to each other? I understand that the dataset has a complex structure so I tried several times, but I still do not understand this argument.

Response: Section 4.1 describes the evidence for enhanced use of labile substrates in the whole soil profiles supporting the hypothesis that the whole profile can enhance the temperature response of microbial respiration via a priming effect. The reviewer's comment indicates that this section is not clear and we will seek to edit thoroughly in order to clarify the main point and how it is supported by the findings in this study. This will include more direct reference to the soil respiration data which is in fact previously published. In that case we will consider the best way to present that information citing the publication. We will also consider bringing the supplemental Figure S4 up into the main body of the paper. Clarification through more direct reference to the findings in this study will be made while trying to simplify the discussion of this main point. I would also appreciate if you could refer to Figures and Tables in the Discussion to make it easier to follow.

Response: As indicated with the specific comment on Section 4.1 we will keep this in mind and provide such references to Figures and Tables where it will help the reader follow the key points.

Line 558: Soil R?

Response: That was meant to refer to soil respiration. We will be sure to spell it out in each case to avoid confusion.

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Line 587: What do you mean with “a climate relevant range of availabilities”?

Response: Here we are referring to the significant differences in soil organic nitrogen availability (measured as N turnover; Philben et al. 2016) captured from across the regional climate transect studied. This transect represents a range in mean annual T and mean annual precipitation congruent with predictions in climate change for this region over the next century. Thus we are referring to differences in soil N availability relevant to the different climates experiences in these forests. We will edit this to clarify.

Technical corrections

Line 162: “Provide” instead of “provides”.

Response: Will fix.

Figure 2: The two types of blue squares are difficult to distinguish.

Response: Will fix.

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Interactive comment on Biogeosciences Discuss., <https://doi.org/10.5194/bg-2020-404>, 2020.

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