Comment on egusphere-2022-1418

Anonymous Referee #1

Referee comment on "Seasonal controls override forest harvesting effects on the composition of dissolved organic matter mobilized from boreal forest soil organic horizons" by Keri L. Bowering et al., EGUsphere, https://doi.org/10.5194/egusphere-2022-1418-RC1, 2023

This study investigates the seasonal variations in dissolved organic matter fluxes and concentrations from the organic layer of boreal forests. Sites that have been logged ten years ago are compared with unharvested controls in a replicated experimental design.

The study design is sound, and the information generated is original and pertinent. DOM originating from the organic layer of boreal forests represent an important and poorly known flux of carbon that may be affected by disturbances and climate change. The factors that control this flux as well as those that control the quality of DOM are poorly known. This study brings new knowledge on how disturbances and climate change may affect DOM originating from boreal forest organic horizons. The results, showing a similar response of DOM to climate for both harvested and control plots as well as an important effect of the season are pertinent to better understanding the C cycling of boreal forests.

Response: Thank you for your positive feedback and constructive comments.

Comments:

To better understand the results, more information is needed concerning the experimental design. Specifically, what is the status of regeneration on the harvested plots? Is it bare soil? What is the status of tree regeneration, 10 years after harvesting? Has the site been recolonized by trees? What is the vegetation height, % cover... This information would be useful to understand the results. It is interesting that the differences in water and DOC fluxes are still present 10 years after harvesting. Another study conducted in somewhat similar conditions found coherent results with this one. However, it was conducted one year after harvest: warmer and wetter conditions in harvested treatment led to greater soil humidity, higher soil temperatures, and greater ammonification and DON production of harvested plots in the fall season (Coulombe et al. 2016). Can the author comment on the reason for a 10-year effect?

Response: Thank you for raising these questions. We will provide further details in section 2.1 Site Description to include these important details that will help provide critical context. The harvesting practices left the soil intact, however, post-harvest planting did not take place (the normal practice in the region). Therefore, regeneration of conifers remained sparse at the time of this study with the few trees that were established below 1.5 m in height at the time of the study. Soil surfaces of these harvested plots also had naturally recovered moss, herb and shrubbery at the time of this study. Part of this can be visualized in figure S1, an aerial photo taken not long after the initiation of the study (Figure S1).

We did expect 10-year post harvest effects attributed to a reduction in both litter and moss inputs, increase water input and decrease water residence times in surface soils of the harvested plots, and the consequences of these impacts on the organic layer physical and chemical *composition (e.g. decreased thickness and C:N; Bowering et al. 2020). We will add a bit of information on these differences in this section as well to help clarify relevant treatment differences and potential for their impacts on soil DOM composition.*

Minor comments

l.54: fate of DOM: there is abundant literature on the importance of mineral soil properties on the fate of DON that could be mentioned here.

Response: Good idea. We feel this is best incorporated where we discuss the importance for understanding the composition of the surface sources of DOM studied here because this study does not focus on organo-mineral interactions. We intend to insert this information within later lines in the introduction as:

While soil extractions provide valuable information on potential sources, bioavailability, and production mechanisms of soil DOM (i.e. (Jones and Kielland, 2012)(Hensgens et al., 2020), as well as transformation and fate in mineral soil (Kothawala and Moore, 2009), they cannot capture the interaction of these factors with local hydrometeorological conditions important to understanding the net movement of DOM *in situ*.

l.74: recalcitrance of coniferous litter, how about that of bryophytes, are they not present?

Response: Yes, forest floor mosses are quite abundant and important in these forests. We will insert that here with references for slow turnover of moss tissues.

l.104: 10 years may not be considered long-term in a rotation that lasts more than 50 years; preferably use 10 years, – also line 535 and elsewhere.

Response: This is a good point. We will remove "long-term" in both instances and clarify the 10-year time frame.

l.381; l. 535 and elsewhere: the use of Sr for slope could be misleading (Strontium), use another notation.

Response: We will change this to S_R *throughout.*

Discussion/conclusions

Winter rain/thaw events are increasing. The results of this study suggest that these events may bring more transformed DOM into streams. Is it possible to support this claim by referring to studies in warmer ecosystems, such as coastal Maine or New England?

Response: We agree it would be helpful to refer to catchment studies in the region or further south. However, with the predicted warmer winters our results suggest we would expect more organic soil layer derived DOM, but in a less transformed state, mobilized from these landscapes (see lines 623-635). Given this comment it looks like we need to clarify that, and will include reference to studies such as (Huntington et al., 2016) *where increasing trends in terrestrial inputs and riverine DOM associated with winter transport has been documented and thus consistent with these findings.*

Reference:

https://doi.org/10.1139/cjfr-2016-0301 Coulombe et al. 2016. Effect of harvest gap formation and thinning on soil nitrogen cycling at the boreal–temperate interface

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