

Interactive comment on “The relative importance of photodegradation and biodegradation of terrestrially derived dissolved organic carbon across four lakes of differing trophic status” by Christopher M. Dempsey et al.

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Thank you for the comments and suggestions. We will work to incorporate them in a revised manuscript. Below I have replied to specific questions/statements using line numbers from the original manuscript.

Line 84: This can be added

Line 95: To our knowledge there are only a handful of paired bio and photodegradation studies. It is certainly possible that colder temperatures slow the rate of biodegrada-

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tion in the Arctic. The length of photodegradation experiments are important. Sunlight acts much more rapidly than bacteria.

Line 97: This is related to the uncertainty in organic carbon inputs, processing, and burial within aquatic ecosystems on regional or global scales. Butman et al, 2016 provides an explanation of some of these reasons.

Line 104/105: We can change our reference to optical/absorbance characteristics to CDOM.

Line 107: No. We were trying to point out that sunlight effects DOC in other ways (i.e. other than mineralization).

Line 125: Yes. We could have phrased that to be clearer.

Line 126: In the papers we cited, the optical properties were different between forested and disturbed study sites.

Line 183: Yes. That can be added

Line 209: We did not include it in this manuscript but we did run a combined photodegradation and biodegradation treatment. The response in those treatment was similar to the photodegradation only treatments, but greater (i.e. more DOC lost or more DIC produced). This would certainly be something to explore further, but we did not test microbial abundance at the beginning and of those treatments. It is possible that UV exposure lysed cells, which were more susceptible to photodegradation.

Line 239: For the biodegradation experiments, we wanted to provide a fresh source of bacteria. In hindsight, we should have used lake water, but we only had groundwater shipped from Annie. For consistency, we opted to use groundwater for all experiments. We did not test the short term response to DOC here, but since 2016 we have run additional experiments since 2016 to test out shorter time frames (i.e. 48 hours). Neat suggestion.

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Line 255: The average temperature (measured at 0.1m) for each 7 day experiment in Lacawac was as follows: May- 15.1, June 20.1, July- 25.4, August 26.2. All are degrees Celsius.

Line 277: This can be added

Line 299-308: Good suggestion. This can be incorporated.

Line 314: Yes. Monthly differences is the same as seasonal response. It could be lake temperature, but it may have more to do with how long it took to filter the Lacawac groundwater. Annie water was shipped to us each month and there is not a strong seasonal response in that lake (SI Fig 3). For Lacawac, the groundwater was collected in early May, but we were unable to filter the remaining water until ~10 days later. There was a large amount of particulates in the samples which may have continued to degrade. It is not reported in the manuscript but for Lacawac starting concentration of DOC in May, June, July, and August was ~48, ~63, ~63, and ~61 mg/L. While we did not assess the role of temperature, the starting concentration of DOC is important. Temperature does influence the photodegradation process.

Line 377: It is possible temperature played a role. One the timescales in which we conducted the experiments, photodegradation acts much more rapidly on the DOC pool when compared to bacteria.

Line 487-493: We kept the treatments separate in this manuscript and did not do a combined photo and biodegradation treatment. We also don't know if a combined treatment would kill or lyse bacteria due to UV exposure. Samples were kept at the surface of the lake for 7 days. It would be interesting to test this to determine whether bacteria can survive for 7 days. We do think that the length of time experiments are run is important.

Line 501-503: We think this occurs because the properties of the watershed influence the lake. Lacawac and Annie have bog areas that contribute to their brown water

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description. There is likely a fraction of the DOC pool in each lake that is capable of being biodegraded, a fraction that is capable of being photodegraded, and a fraction that not able to be processed. More of this can be added to the discussion.

References: Butman, D., Stackpoole, S., Stets, E., McDonal, C.P., Clow, D.W., Striegl, R.G. 2016. Aquatic carbon cycling in the conterminous United State and implications for terrestrial carbon accounting. PNAS: 113(1), 58-63.

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