Biogeosciences Discuss., 8, C3394–C3396, 2011
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Biogeosciences Discussions

Interactive comment on "Water table height and microtopography control biogeochemical cycling in an Arctic coastal tundra ecosystem" *by* D. A. Lipson et al.

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Received and published: 2 October 2011

Both reviewers were positive about this work and its eventual publication in Biogeosciences. However, both wanted to see the most important and novel findings of the study highlighted, and found aspects of the presentation confusing.

I admit the paper is packed with data, and some major points could easily get lost within it. I considered splitting up this work, but I decided it was preferable to write a single, high impact paper (especially given how hard it is for me to find the time to write). Here is summary of what I believe are the key findings:

(1) Fe cycling shapes fine-scale landscape variation of soil chemistry in this system.

Previous work showed that Fe-reduction was an important process in this ecosystem, but we lacked detailed knowledge of how this process interacts with the extensive microtopographic variability found in landscapes of the Arctic coastal plain.

(2) High concentrations of siderophores in response to anoxic conditions explain high Fe(III). Previous work found high levels of dissolved Fe(III) in soil pore water, but the mechanisms, beyond the general presence of dissolved organic matter, were unclear. Here we show that siderophores are present, and the correlation among siderophores, Fe(III) and low redox values suggest that the microbial commuity responds to low redox conditions by solubilizing Fe(III).

(3) High ratios of CO2:CH4 are found in soil pore water and in anaerobic laboratory incubations, and this is best explained by the presence of the availability of Fe(III) as alternative e- acceptor. This has clear relevance for understanding current and future C budgets of this ecosystem.

(4) N and P cycling was enhanced by flooding. Flooding can lead to deeper thaw depths and warmer soil temperatures, leading to increased mineralization. Increased reducing conditions may also release P. This result has significance for ecosystem responses to lake expansion in areas of continuous permafrost.

The fourth key finding is the one that could most logically be split off into a separate short note. I am inclined not to do this, as it would delay publication of this fairly important result.

I found the numerous suggestions for improving the presentation helpful, and would adopt the majority of them in a revised manuscript. For example, Reviewer 1's suggestions to better integrate the nutrient cycling into the introduction, mention the 2010 sampling in the methods, and to be consistent in pooling the two control areas (C and S) are good points. Reviewer 2 suggested presenting the CO2:CH4 data in a figure. I think this is a good idea, though a new table might be easier to manage. Overall, I am sympathetic to readers having difficulty wading through the large amount of data

presented here, and I appreciate the suggestions for ways to clarify the results.

The only comment I couldn't quite understand was Reviewer 2's request for "deeper analysis." I feel the statistical analysis was careful and complete, and that the interpretation of the results was similarly detailed and thoughtful (this reviewer did comment positively on the discussion). If deeper analysis here refers to better integration into a larger scientific context, then I agree, and will address this issue by more strongly emphasizing the novel aspects of the work and their broader significance. Or, if the results failed to convey the depth and accuracy of our data analysis, then improving the presentation of the results as suggested should remedy this.

There were also numerous specific suggestions from both reviewers for improving the presentation, which I found helpful, but don't seem to require a response other than, "Good point! Thanks!"

In summary, I appreciate the detailed and careful comments of both reviewers. Their points are well-taken, and will improve the quality of the manuscript.

Interactive comment on Biogeosciences Discuss., 8, 6345, 2011.