Biogeosciences Discuss.,
doi:10.5194/bg-2016-24-AC4, 2016
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Biogeosciences Discussions

Interactive comment on "Temporal variation in carbon and nitrogen sequestration rates in boreal soils across a variety of ecosystems" *by* K. L. Manies et al.

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Received and published: 5 May 2016

Dear Dr. Zaehle,

Thank you very much for you suggestions on how to further improve our manuscript. We have uploaded a new version with changes made based on your suggestions. After a careful review we made sure that our manuscript either restates pertinent information, or refers the reader to the location of that information within the text (i.e., line 282). In addition, we have clarified our justification in assigning the ages used to calculate long-term C accumulation rates. This includes showing the results of our sensitivity analysis (new Table S3), which demonstrates that any uncertainty related to the age of the black spruce profile would not affect our results.

The updated text (line 183) and Table S3 are below. Please let me know if you have any additional questions.

Thank you,

Kristen Manies

Updated text: "14C dating of the basal organic soil layers provided information regarding the initiation of soil development. This approach shows that the rich fen is the oldest ecosystem, at approximately 1390 years old (Table S2). Age estimates for the shrub and sedge ecosystems ranged between 700 and 856 yrs cal BP. Unfortunately, we did not get ages for the black spruce or tussock grass ecosystem (due to sample size limitations). Therefore, for all ecosystems except the rich fen we used an initiation age of 780 yrs (the median of the two ages listed above). We justify this approach using the following logic. First, all of the ecosystems appear to be relatively stable and lay within ∼300 m of each other, along an emergent landform that grades from the rich fen up to the black spruce forest. Therefore, all ecosystems along this gradient likely formed within several hundred years of each other. This assumption is supported by the fact that the sedge ecosystem is only ∼100 years older than the shrub ecosystem. The grass ecosystem also lies between the shrub and sedge ecosystems along the gradient; therefore, its age of formation is likely similar to the values measured for these two ecosystems. Although the black spruce ecosystem lies at the end of the gradient, a sensitivity analysis demonstrates that a dramatically different initiation age would be needed to impact our results (Table S3). Therefore, even if 780 yrs is not accurate for the black spruce ecosystem, realistic variations in this value (+/- 400 years) would not change the outcome of our analyses."

Please also note the supplement to this comment:
http://www.biogeosciences-discuss.net/bg-2016-24/bg-2016-24-AC4-supplement.pdf

Interactive comment on Biogeosciences Discuss., doi:10.5194/bg-2016-24, 2016.

Table S3. Results from the sensitivity analysis to determine the potential impact of black spruce ecosystem. Long-term C accumulation rates using different ages for th ecosystem were compared to accumulation rates of the three other non-fen ecosy grass, and sedge) and, separately, the rich fen ecosystem. Only when the black spru years old does its long-term C accumulation rate differ significantly from the non-fe become similar to the rich fen ecosystem. The long-term C accumulation rate for th ecosystem found in the manuscript is 8 +/- gC m^{-2} yr^{-1}, based on an age of 780 yrs (s more information).

Selected age of black spruce ecosystem	Long-term C accumulation rate using that age ($gC\ m^{-2}\ y^{-1}$)	Are black spruce long-term C acc rates significantly different when com	
		Non-fen ecosystems (p-value)?	Rich-fen ((p-va
200 yrs	32 +/- 5	Yes (0.031)	No (0.045
300 yrs	22 +/- 3	No (0.30)	Yes (0.003
500 yrs	13 +/- 2	No (0.45)	Yes (0.000
1000 yrs	6 +/- 1	No (0.16)	Yes (0.000
1400 yrs	5 +/- 1	No (0.11)	Yes (0.000
1600 yrs	4 +/- 1	No (0.09)	Yes (0.000