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Interactive comment on "Vascular plants affect properties and decomposition of moss-dominated peat, particularly at elevated temperatures" *by* Lilli Zeh et al.

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This manuscript examines the influence of variations in plant cover on the rate of decomposition in the upper layers of the peat profile, at two sites in the Italian Alps, which vary in their mean annual temperature. The aim is to provide some indication of what may happen if climate change warms peatlands and the vegetation cover of sedges (here Eriophorum) and shrubs (here Calluna) increases at the expense of Sphagnum moss. Peat cores were analyzed for a wide range of properties, related to degree of decomposition, including pyrolysis, which is unusual in peat studies. The results suggested that both temperature (over a 1.4oC range) and vegetation cover influenced

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decomposition rate of the peat, dominated by residual moss, but that changes in vegetation to sedges and to a lesser shrubs, were more important than the temperature rise, using the two sites as proxies for change.

This contribution is one of several suggesting that changes in vegetation from global change are likely to be more important than simple rises in temperature in affecting the C budget of ecosystems, for example the 'shrubification' of the Arctic. Here, detailed and careful sampling of two sites, with modest differences in air temperature but varying in vascular plant coverage 47 and 77%), provide a suitable analogue to address this issue. The peat samples, and vegetation, have been analyzed by a variety of techniques, some of them common, such as elemental and stable isotopes, and some less common, such as gc/ms pyrolysis. The content of the manuscript is suitable for Biogeosciences and it is generally well written, though I have noted a few errors of the pdf, along with some specific comments.

Some comments for 'discussion':

The sites vary in terms of their mean annual temperature, but is this translated to similar differences in the peat layer undergoing decomposition? Are soil temperature data available to be more precise on the thermal differences in the peat at the two sites? It might be smaller or larger than the 1.4oC.

Is there an estimate at the rate of peat accretion at the sites? In other words can you estimate over what period the 20 cm of peat have accumulated (e.g. by 210Pb dating, perhaps a century?) and what are the changes in the environment over that period? Is what we see now, the same as what it was a century ago, when the current 20 cm peat began to form? For line 263, can you provide an estimate of 'increasing time of exposure'?

Do you have any estimates of the input of litter into the sites, based on the vegetation composition, to provide a quantitative context of 'how much' is being added? The references cited (lines 41-42) tended to be for Arctic tundra, which is presumably inapplicable to alpine conditions.

I think that careful attention should be given to the water table at the two sites which are reported on line 89. Perhaps the Zeh et al. (2019) ms contains more specific information, but a difference in water table of 30 cm (the minimums reported) would have a profound effect on decomposition rates in the peat cores, the High T site being both warmer and drier ……. Was August 2015 to July 2016 'typical' in terms of hydrology (i.e. precipitation etc.)? On the other hand, if the highest water table measured was 17 and 15 cm, it means that only the bottom 3 to 5 cm of the 20 cm core were at and under the water table, so we are dealing with decomposition under aerobic conditions, effectively the acrotelm. Perhaps a useful metric would be the proportion of the year in which the water table was within the 20 cm core, especially the 15-20 cm section, to see whether hydrology was significantly different at the two sites. An increased vascular cover, associated with a warming, will likely increase evapotranspiration rates, which in turn will produce a lowered water table, accelerating the vascular 'invasion'.

Eriophorum is arenchymous, with the capacity to oxygenate the peat: would that influence the peat environment in terms of decomposition rate, given that the top 20 cm is above the water table for most of the year?

Line 190: I was surprised to see the large increase in C:N ratio with depth in nearly all the cores, whereas with decomposition one might have expected a decline in the ratio. Is there an explanation for this pattern – I could not see one in the Discussion (cf Table 1). Does atmospheric N deposition play a role here (larger N concentrations in the past few decades)?

Line 230 I would think that there are major differences in 15N among the three plant types from zero to -10, which relate back to, I assume, the mycorrhizal dependance of Calluna, the non-mychorrizal Eriophorum and moss in between

I got goggle-eyed looking at the symbols in Figures 1, 2 and 4 and would appreciate some differentiation stronger than washed-out blue and a yukky looking green. Be

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‘artistic’! Simple black and red would be nice. . . .. .

4.2.2 is a 45 line ‘paragraph’ and it might be easier to digest if it was broken down into three paragraphs, each dealing with a specific theme. It is a ‘confounding’ system with multiple interpretations of results and the strength of the ms is the range of analyses conducted.

In the Conclusion, or somewhere in the Discussion, it would be useful to identify the ‘bang for the buck’ in these analyses: some are simple and routine and some, especially the gc/ms pyrolysis, is ‘labour intensive’. Do you have anything to add to the Biester et al. 2014 paper, based on this specific application?

I provide a copy of the pdf which I have annotated with comments and suggested typographical and other correction.

Tim Moore

Please also note the supplement to this comment:
https://www.biogeosciences-discuss.net/bg-2019-503/bg-2019-503-RC2-supplement.pdf

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