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Discussions

Interactive comment on "Environmental and taxonomic controls of carbon and oxygen stable isotope composition in *Sphagnum* across broad climatic and geographic ranges" *by* Gustaf Granath et al.

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General comments: The manuscript by Granath et al presents a large northern dataset of d13C and d18O from Sphagnum magellanicum and Sphagnum fuscum tissues. Results show promise for d18O from plant tissue as a proxy for d18O from precipitation; the relationship between tissue and source water could be used broadly to reconstruct changes in precipitation from peat core records. The relationship between d13C from plant tissue and environmental conditions was shown to be a little more complicated to interpret because of species-specific differences and confounding factors (water table

and NPP primarily). The dataset presented here is coherent and spans a broad range of climatic conditions. To my knowledge, the statistical tests performed are adequate and provide honest/reliable results. In general, this is a much needed review of what is known (and what remains unclear) about the relationships between environmental conditions and the stable isotope signature of Sphagnum tissues. This synthesis might help us better understand Sphagnum physiology and its adaptation to local conditions. Also, the text reads well and should be well received by the BG audience and particularly by the terrestrial ecosystem ecology and paleoclimatology communities. I recommend publication of this manuscript pending that the following specific and technical comments be considered in the final article:

Specific comments: (1) the use of Sphagnum CAPITULUM for the analysis – we know that many other authors have used stems OR leaves in the past and that these 2 types of tissues have different d13C values (see work by Loader for a discussion on the offset); also, there might be translocation from the apex down to the stems and leaves (see work by Bragazza) – I wonder what a difference it makes to analyze the capitulum vs. the top part of the stem. Could this partly explain the relatively wide spread of data you obtained with d13C?

(2) water table measurements at the END of the growing season: I wonder if part of the somewhat weak relationship between d13C and HWT could be caused by a contracted spread of HWT? Assuming that the dry end of the microhabitat remains dry throughout the growing season, but that the wetter microhabitats tend to dry out over time, it is possible that measuring HWT at the end of summer does not provide an accurate picture. If photosynthesis was to preferentially occur early during the growing season (i.e., under wetter conditions) and then stop, the pattern you observe could be in part explained by a sampling bias.

(3) I'd like a precision on the bulk density measurements: it is said that the top 30mm of the stem were used to calculate BD; how was volume determined?

(4) Figure 2: A discussion on regional differences that you found across your dataset would be useful. For example, are there areas where d13C and HWT was more strongly correlated then others? what about d13C and NPP? Or was NPP more strongly correlated for wetter samples? Same goes with d18O and P, as well as d18O and Evaporation: is there anything else that could be learned from within your dataset?

(5) Figure 3: i'm curious to know more about the d18O values between -20 and -15 permille; they are almost all poorly predicted by your linear model. Where do they come from? what might explain their 'unusual' signature?

Technical corrections:

line 204: add a space between and_are

line 251: we first builT (change the builD for builT) ... and WERE identified (change ARE for WERE). Everything else in here uses past tense

line 286-287: "S. magellanicum..." should follow the previous sentence; there is currently a 'line jump'.

Julie Loisel April 20 2018

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