

Journal: BG

Title: Microtopography is a fundamental organizing structure in black ash wetlands

Author(s): Jacob S. Diamond et al.

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Responses to Referees

Anonymous Referee #2:

We thank Referee #2 for their detailed review of our manuscript. We have broken out your individual comments (RC) and responded to each accordingly (AC). We hope that our comments address and clarify any issues or concerns that they may have.

Overall comments:

RC1: This work presents an interesting question and is within the scope of Biogeosciences. It is well written and the conclusions are sound, however care should be taken in how the story is presented. I don't think it's quite as black and white as the authors seem to state regarding microtopography being primary control on vegetation communities.

AC1: We appreciate the Referee's careful consideration of our interpretations, and we will be sure to temper language throughout in accordance with the Referees recommendations.

RC2: I believe it will be a useful addition to the literature after some major revisions. The manuscript is rather long and could do with being streamlined, especially in the methods and results section. In particular I found it difficult to follow section 2.3 (Data analysis). Although the methods used are sound and appropriate, it was very difficult to follow to see what was done where. There was also a little bit of repetition throughout this section where the authors would state why they are going to use a test multiple times

AC2: We are happy to streamline the text, especially in the Methods and Results to improve readability.

RC3: One of my major concerns throughout this manuscript was the frequent absence of citations in the reference list, that are referred throughout the paper. A thorough check of this is needed. Conversely, there are citations in the reference list that are not included in the main body of the text. Also, it is not clear to me whether Diamond et al. In Review which is referenced many times throughout this work has been submitted to the same journal? The authors make reference to a complimentary paper (Paper I) in line 70 but I am unsure if this is the same paper. There is no guarantee that paper will be published before this one, therefore I think it is important that the authors remove reference to this paper in review and expand where necessary in the main body of the text. It can not be expected that readers just assume a paper will be published in due course and be OK with lacking details within this one.

AC3: We sincerely apologize for the numerous issues associated with citations throughout our manuscript; this was noticed by the other Referees as well. We have fixed all citation issues and note them here in our response, and note that Diamond et al. [in Review] (accidentally referred to Diamont et al. at one point) is published now as:

Diamond, J.S., McLaughlin, D.M., Slesak, R.A., and Stovall, A. Pattern and structure of microtopography implies autogenic origins in forested wetlands. Hydrology and Earth System Sciences, in Press.

Detailed comments:

Title and Abstract:

RC4: Title: Organizing structure of what? The title does not link well with the main results of the text. I believe more reference to the influence on vegetation communities might be clearer here.

AC4: Our intent was that “organizing structure” refer to the structural backbone of ecosystem function of black ash wetlands, as is often mentioned in the ecological literature (i.e., “structure and function of ecosystems”). We understand that this may be ambiguous to some and we will amend the title to “Microtopography is a fundamental organizing structure of vegetation and soil chemistry in black ash wetlands”.

RC5: Line 10-11: Local deviation in soil soil elevation sounds awkward – do you mean deviation above the water table?

AC5: Yes, good catch, and we will make this change.

Introduction:

RC6: Line 30: This is the main organizing structure – or is it the water table position is – and that just influences everything else?

AC6: Our perspective is that microtopography modulates local water table position, thereby affecting and organizing all processes that are influenced by soil moisture.

RC7: Line 35: Strack reference and Sullivan reference are missing from reference list

AC7: We sincerely apologize for the multiple issues with references. We will fix this in the revisions.

Strack, M., Waddington, J.M., Rochefort, L. and Tuittila, E.S., 2006. Response of vegetation and net ecosystem carbon dioxide exchange at different peatland microforms following water table drawdown. Journal of Geophysical Research: Biogeosciences, 111(G2).

Sullivan, P.F., Arens, S.J., Chimner, R.A. and Welker, J.M., 2008. Temperature and microtopography interact to control carbon cycling in a high arctic fen. Ecosystems, 11(1), pp.61-76.

RC8: Line 43-44: All these references are missing. This is happening throughout the paper – please check and amend.

AC8: We sincerely apologize for the multiple issues with references. We will fix this in the revisions.

Rietkerk, M., Dekker, S.C., Wassen, M.J., Verkroost, A.W.M. and Bierkens, M.F.P., 2004. A putative mechanism for bog patterning. The American Naturalist, 163(5), pp.699-708.

Heffernan, J.B., Watts, D.L. and Cohen, M.J., 2013. Discharge competence and pattern formation in peatlands: a meta-ecosystem model of the Everglades ridge-slough landscape. PloS one, 8(5), p.e64174.

RC9: Line 48: / missing between hummock and hollow

AC9: Thank you, we will add a dash (“-”) between these words.

RC10: Line 70: What paper is Paper I? Is it in review in same journal? I don’t think it’s clear to refer to this paper in this way, unless they were submitted together?

AC10: We will fix this in revisions, but Paper I is:

Diamond, J.S., McLaughlin, D.M., Slesak, R.A., and Stovall, A. Pattern and structure of microtopography implies autogenic origins in forested wetlands. Hydrology and Earth System Sciences, in Press.

Methods:

RC11: Section 2.1: You need to give more background information. I am still unclear whether these wetlands are peatlands or mineral wetlands? This has not been defined anywhere. It would be really useful to give the depth of organic matter, the dominant vegetation communities present, meteorological conditions etc.

AC11: We will include all of this information in our revisions, which we cover in more detail in previous work. The wetlands vary between their soil types, depth of organic matter, but are all dominated (75–100% cover) by black ash.

RC12: Line 95: You can't expect the reader to go and read an unpublished paper. You need to expand the methods here.

AC12: That paper is published now. We elect to not expand the hydrology methods here because it will increase the length of the paper (which was requested to be shortened by the reviewer), and because those methods are detailed in their entirety in this work:

Diamond, J.S., McLaughlin, D.M., Slesak, R.A., and Stovall, A. Pattern and structure of microtopography implies autogenic origins in forested wetlands. Hydrology and Earth System Sciences, in Press.

RC13: Line 104: Space needed between create and 1cm

AC13: Thank you, we will correct this.

RC14: Line 110: How big are these plots? Are they the same plots as the 300m² circular plots used in the elevation data collection

AC14: Yes, these are the same plots, but we will clarify this in our revisions.

RC15: Line 117-118: What was used if you did not know the species? It would be useful to include a sentence such as "Vascular plant identification were made according to X and non-vascular plant identification according to Y".

What nomenclature was used? What was the breakdown for percent foliar cover – 1, 3, 5 and then to the nearest 5%?

AC15: We discuss at the end of this paragraph that "Species that we were unable to identify in the field were assigned a genus or standard unknown code and collected in a bag for later identification."

We will include in our revisions a sentence for the tools used for identification, but note here that we used two main sources: 1) a local wetland plant/moss identification manual, and 2) a regional wetland plant identification guide.

The nomenclature used depended on the species (for example, see Table 1) because not all species had the same nomenclature system (particularly for mosses), but we included nomenclature in all of our identification.

Indeed, we used the 1, 2, 5, and nearest 5% approach for percent foliar cover and will note this in our revisions.

RC16: Line 139: Does air-drying allow for a consistent drying method? Why not use an oven?

AC16: To the best of our knowledge, air-drying wetland soil is a common method used across many wetland systems and recommended by Reddy and DeLaune, Biogeochemistry of Wetlands: Science and Applications. We will further note that soils were air-dried to constant weight, and were extremely friable when we ground them. We will include a discussion of possible artifacts of this method in the Discussion. We do not believe that our approach is dubious or that alternative drying methods would substantially change our results, particularly for our most compelling results for Cl and PO₄³⁻.

RC17: Line 149: Hydrologic metrics? Do you just mean water table depth?

AC17: Water table depth was our state variable, but several simple statistical metrics were calculated from it. We will be more specific in our language in our revisions, and note that median and mean water table were the most predictive of our independent variables.

RC18: 2.3. Data analysis: This whole section is really quite confusing and very wordy—I think it would be useful to streamline this without losing the integrity of the work.

AC18: We will reduce the text here and streamline this section in our revisions. For example, we can reduce much of the methodological specifics in the Understory composition section (2.3.1) and the Soil chemistry section (2.3.3).

Results:

RC19: Lines 218, 224, 253, 269 (and any I missed): This is not enough information for the results of a statistical test. It's also unclear what test has been used. The correct way to present this data would be, for example; (ANOVA, F=0.12, p < 0.0001). Please correct throughout.

AC19: On line 218, we are referring to the OLS in Figure 2, and will include the F values for the linear regression in our parenthetical reference; and the same for line 253. On line 224, we will include the F values for the PerMANOVA test in our parenthetical reference. In line 269 we are referring to an ANOVA, and will report the F value, as well.

Discussion:

RC20: It's still unclear to me what type of wetlands these are? This needs to be made explicitly clear.

AC20: The commonality in our study sites is that they are all black ash wetlands, but have variable soils and hydrogeomorphic settings. We will be much more explicit here and also in the Site Descriptions so that there is no ambiguity.

RC21: Line 385: This is where it would be useful to make it clear what type of wetlands these are. The term northern bog wetlands is awkward – bogs are peatlands, therefore wetlands.

AC21: We will rephrase to say "northern bogs". Our wetlands are not bogs; we only use these references in this sentence to support the notion that areas with trees (cf. hummocks in our study systems) can be sites of increased evapotranspiration relative to areas without trees (cf. hollows in our study system).

RC22: Line 434: Is it microtopography or is it water table as the primary control? I understand that this is a useful study and I don't dispute the findings, but I wonder if stating that microtopography is the primary control is not exactly what is shown – rather water table depth and vegetation community dictate microtopography?

AC22: We agree entirely, and try to point to this later in the sentence with "...while also suggesting that it arises from biogeomorphic feedback processes that concentrate biomass and nutrients into hummock structures." We will refine our language here to better reflect this perspective: that microtopography is created and maintained through feedbacks between hydrology, vegetation, and soil (organic matter). So, microtopography controls the vegetation and soil, but water table and vegetation/soil also control the size and distribution of microtopography.

Figures

RC23: Ten figure seems excessive – and they are hard to follow. Could a few be sent to the supplementary information without losing the story?

AC23: We agree, and are fine with moving Figures 4, 5, 6, and 7 to the supplementary information.

RC24: Figure 1: An inset figure of where Minnesota is in context of the United States would be very useful These sites are quite far north.

AC24: We will include an inset of Minnesota in a new map.

RC25: Figure 2: The Y axes of these plots are not the same, so sharing an axis title is rather confusing. They are on a different scale. Define what D, L and T are again in the figure caption.

AC25: We will split the y-axes and define what D, L, and T are in the caption.

RC26: Figure 3: The ellipses used in this figure are very hard to tell apart–please use another colour or line type.

AC26: We will change these colors to be more clear.

RC27: Figure 4: This could be moved to the supplementary information

AC27: We will move this supplementary information.

RC28: Figure 6: Again, define D, L, T in figure caption

AC28: We will define these in the caption, and also move to supplementary information.

RC29: Figure 7: This could be moved to the supplementary information.

AC29: Agreed, we will move this to the supplementary.

RC30: Figure 8: You have no legend as to what the colours mean in this figure.

AC30: In the caption we indicate that "colors indicate site type".

RC31: Figure 9: This could be moved to supplementary information

AC31: We disagree with the Referee here, and think this is important to include in the manuscript, but we appreciate the importance of reducing the total figure count.

RC32: Figure 10: This could be moved to supplementary information

AC32: We disagree with the Referee here, and think this is important to include in the manuscript, but we appreciate the importance of reducing the total figure count.