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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Regional and local patterns in depth to water table, hydrochemistry, and peat properties of bogs and their laggs in coastal British Columbia" *by* S. A. Howie and H. J. van Meerveld

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Author's Response to Review #1

We thank the reviewer for his/her thorough review of this paper. The attention to detail is greatly appreciated, particularly the emphasis on the data and statistical analyses. We address the general comments and each specific comment below.

General Comments:

Length of manuscript: The reviewer comments that the text of the manuscript could be more concise. We will review the paper with this in mind and make adjustments where appropriate.

Contribution beyond British Columbia:

We agree that the usefulness of the results of this study for directly describing local analogues or reference sites is limited to coastal BC and that the observed patterns may not be directly applicable to other regions. However, we do think that it is of interest to other researchers (and resource managers) to know that there are large variations in lagg characteristics locally and regionally. Thus, while the values and patterns reported in this manuscript are indeed specific for this set of coastal bogs, we do not agree that the results presented here are only of local interest. We believe that the results of this study are of interest to other researchers because:

1. In general, very little is known about the lagg and gradients across the lagg. Thus, describing the patterns in hydrological and hydrochemical characteristics and their variability expands our currently limited knowledge base on the role of the lagg in raised bog development and conservation. We are not aware of other studies that have reported such variability of lagg characteristics.

2. The reviewer highlights the novelty of showing the pattern in ash content from the bog expanse to the bog margin, and acknowledges that this is an under-reported parameter. Most studies on laggs have focused on topographic, hydrological, and hydrochemical parameters for determining the location of the transition from ombrotrophic to minerotrophic conditions (i.e. the bog expanse – bog margin transition). In contrast, we found that ash content of near-surface peat appears to be a more useful abiotic parameter for bog margin delineation. Other researchers may find this information useful for studies in other regions, as ash content is not commonly measured in lagg studies. We will make this point even stronger in the manuscript.

3. Related to point #2 above, we found that about half of the lagg sites that we studied

had pH and calcium concentrations similar to bog conditions (ombrotrophic), while the other half were more minerotrophic, as discussed on P3161 L5 – P3162 L7 (also see Figure 1 and comments below). We attributed this difference to the ash content of near-surface (top 50 cm) peat, rather than topography or peat depth. This information may be useful for researchers or managers attempting to delineate the boundaries of a bog ecosystem.

4. Much of the literature on raised bogs is based on studies in Europe and eastern Canada. Less is known about raised bogs in western Canada. As such, this study adds to the literature on bogs and laggs by adding information about gradients at the bog margin in another region.

We will stress the usefulness of these results for developing local reference sites less and more clearly point out the usefulness of the results of this study for bog researchers in other areas.

Specific Comments:

Table 2: The reviewer comments that there appear to be inconsistencies between the values in Table 2 (depth to water table and hydraulic gradient) and those reported in the text. We have reviewed these data and think that the reviewer has misinterpreted our definition of "water table gradient". We calculated the hydraulic gradient (or "the water table gradient", as we assume that the water levels measured in the shallow piezometers also represent the location of the water table reasonably well, as explained on P3151 L8-14) by dividing the difference in the elevations of the water table at R1 and LG by the distance between R1 and LG, giving the percent slope of the water table between R1 and LG. The elevation of the water table was calculated for each location on the transect by subtracting the depth to water table from the surface elevation that was determined by a survey with a rod and level. For example, in Fig. 2a of the manuscript, one could draw a line connecting the water table at points R1 and LG and calculate the percent slope of that line, which would represent the water table gradient.

The reviewer, on the other hand, presumably calculated the difference between the depth to water table values (R1 - LG) in Table 2. Since the surface elevation of the bogs changed across the study transects, the reviewer's calculation does not give the water table gradient from R1 to LG, but rather calculates the difference in depth to water table between R1 and LG. We will make our calculation clearer and add a column to Table 2 for "surface gradient" so that readers can compare the gradient from R1 to LG for both the ground surface and the water table.

The reviewer also suggests that we use the term "water table gradient" instead of "hydraulic gradient". We can make this change if the other reviewers and editor also prefer this. If they do not agree on this suggestion, we prefer to keep the term hydraulic gradient since these measurements are based on the water level measurements in shallow piezometers and the term hydraulic gradient is frequently used.

P3154 L27 – P3155 L1: The reviewer comments that this sentence suggests that all water table gradients are positive. We were referring to the percent slope of the gradients, and not whether they were positive or negative, but will rewrite this sentence to make this clear. On P3154 L23-25, we note how many of the gradients were positive or negative. We double checked Figure 2, Table 2, and the reference to Oliver Lake, and they are correct. We think that there may have been some confusion about the calculation (or definition) of the hydraulic gradient, and will explain better what is meant by the hydraulic gradient (as described above).

Table 3: The reviewer asks what is meant by "position on the transect" in the caption for Table 3, and correctly guesses that we are referring to the study locations (i.e. BG, R1, R2, LG, MN). The reviewer also notes that this table contains few values. We agree and can delete this table from the manuscript and just describe the significant correlations in the text.

Table 4: The reviewer comments that it is difficult to discern which values are Pearson and which are Spearman correlations in Table 4. We will make this clearer by sepa-

rating the table into two halves (using a line and shading in one half of the table) and labelling them A and B. By top half, we mean the triangle above the 1:1 correlations (e.g., above pH vs pH).

The reviewer also suggests removing Tables 3 and 4, as the figures are sufficient for interpretation of the results. We suggest that Table 4 should be retained so that these correlations may be compared to those found by other researchers but if the editor or other reviewers also think that we should remove both tables, we will do so. We will also ensure that the Results/Discussion section makes clearer reference to these results.

Technical Comments:

P3153 L23-25: The reviewer is correct that the results of the t-tests are not shown in a table in the manuscript, but we refer to the results in the text. We suggest that the addition of the t-test results is not pertinent to the manuscript, as we comment only on the tests that revealed statistically significant differences.

P3154 L27: As noted earlier, we would prefer to use the term “hydraulic gradient”, unless the other reviewers or the editor also suggest that we should use the term “water table gradient” instead.

P3156 L2-6, P3158 L14-15, and P3160 L6-14: The reviewer is correct that some of the significant correlations are not included in Tables 3 or 4. Due to the large number of variables and analyses associated with this study, it was necessary to limit the number of figures and tables to those that best illustrate the results. The relevant results that are not included in these tables are described in the text for reasons of brevity.

P3161: We agree that a figure would be useful to explain the “clustering” of pH and calcium concentrations described in the text. This clustering is relevant because it shows that about half of the water samples from the studied lagg sites appear to be similar to bog water, which suggests that not all laggs are minerotrophic. We left this figure (see Fig. 1 below) out of the manuscript because we wanted to reduce the

number of figures but can include it and explain the clustering more clearly.

P3162 L19-21: The reviewer asks whether “acidity” was measured by titration, or whether it is another measure of pH. We will explain in the methods that “acidity” was measured by titration, and is the measure of the total acidic constituents of the solution, not just the hydrogen ion concentration. We thank the reviewer for pointing out that this is not clear from the text.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 10, 3143, 2013.

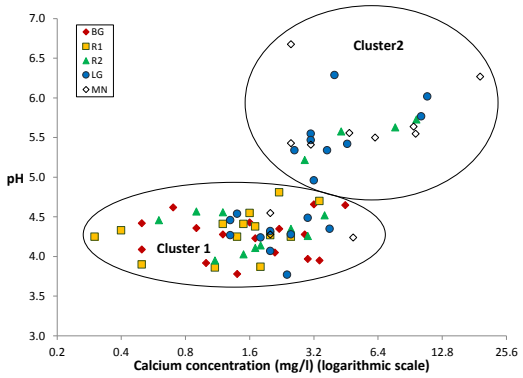

Fig. 1. Relation between pH and calcium concentrations for the studied bogs.