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Biogeosciences Discussions
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Interactive comment on "Salinization alters fluxes of bioreactive elements from streams and soils across land use" *by* S.-W. Duan and S. S. Kaushal

Anonymous Referee #2

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General Comments: The authors used laboratory experiments and field observations of stream sediments and riparian soils to investigate the effects of salinization on bioreactive elements. They posed two hypotheses: 1) dynamics of bioreactive elements in urban watersheds are more sensitive to increased salinization than rural watersheds 2) retention/release of C, N, P, and S can be abiotically and/or biologically coupled Their questions are relevant to the scope of Biogeosciences in that the authors examined responses of stream soil and sediment bioreactive elements to salinization across a rural-to-urban gradient of land use and presented novel data on an important issue. They concluded that for sediment, there is a positive relationship between labile DOC, DIC, TKN and nitrate retention with NaCl concentration, a negative relationship between DOC aromaticity and SRP fluxes with NaCl concentration, and that salinization had a greater effect on sediment releases of DOC, TKN, and DOC quality in

watersheds with a larger percentage of urban land (%ISC). Field observations of water chemistry before and after a snowfall event (and road salting) were similar to sediment incubations with NaCl. Soil DOC responses to salinization in incubation experiments were inconsistent and not explained by urbanization. They attributed differences in riparian soil and sediment responses to site-specific variation in soil organic matter.

The manuscript is generally well-written and, aside from a few missing citations, lays out a good foundation for the study and interprets the results with respect to three mechanisms by which salinization can affect DOC fluxes. The text also contains some small typing errors and the quality of some figures should be improved (see specific comments below).

My main concern regards the methods of data analysis. There are three points in respect to this concern. First, because only one rural site is used (n = 1), I do not believe that the authors cannot address their first hypothesis as stated. Second, results of the one-way ANOVAs are reported for only AFDM, yet magnitudes and trends of responses are reported in the results for all of the bioreactive elements measured; we are not informed as to whether these results are significant. And third, I would suggest using repeated regressions to analyze the data instead of ANOVAs. By setting up their study to sample across a gradient of urbanization, the authors have the opportunity to use this gradient (%ISC) in their analysis. This method of analysis could allow them to describe trends quantitatively. For example, in Figure 2, %ISC could be used as the explanatory variable for three separate regressions (one for each Cl concentration). With this approach, the authors could better support their conclusions about how salinization affects the dependent variables across a gradient of land use change because they could quantitatively compare slopes of the regression lines. Or they could use treatments as the explanatory variable and in the figures, shade points relative to their %ISC or color code by forest, agriculture, suburban and urban categories. After addressing these gaps in analysis and reworking the results and conclusions to reflect their findings, this manuscript will be a solid contribution to the literature.

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Specific Comments:

Title: The title is informative, yet suggests that the results will be interpreted within a framework of land use and only a small section of the discussion emphasizes land use. If the analyses are changed as suggested above, the contents will more accurately reflect the title.

Abstract: This section is a concise summary of the paper.

Introduction: The introduction is short, but provides an appropriate framework for the study. To emphasize the importance of this study, the authors may also wish to include that salinization is difficult if not impossible to reverse, thus, remediation is unlikely. Further, they may want to list saltwater intrusion caused by sea-level rise as another cause of increased salinization that is relevant to this study.

Methods: The authors provide a detailed, clear methods section. Although the site names are specific to the Baltimore Ecosystem Study LTER, and thus used in many other studies, it would be easier for the reader to interpret them according to the main-point of the manuscript if the names relayed the type of site, for example “Forest”, “Agriculture”, and “Suburban 1” or an abbreviated version of those. There are a few additional points to address in this section that could improve repeatability. How long were the samples stored before processing and experimentation? Was nitrite negligible? Were the response variables assessed for equal variance prior to statistical analysis? Were the data transformed? Did the data display normality?

Results: As stated above in the Summary Comments section, the results could be improved by taking advantage of the land use gradient the authors sample across. It looks like there some very interesting trends, but without the statistics to support them, the conclusions are limited.

Discussion: This section is an interesting and comprehensive interpretation of the data. The authors could organize it a bit differently to match the hypotheses and objective

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stated in the introduction. I would also include some remarks about SRP at the agricultural site as this location was likely fertilized. S.C. Neubauer, M. Ardón, J.L. Morse, and A.M. Helton have published additional work that could inform the discussion.

Supplementary Material: Not applicable

Technical Corrections:

Check for consistency of “land use” or “land-use.” It varies throughout the manuscript.

Page 7414, Line 17-18: Rephrase to clarify “and improve water quality by benefitting our assessment and management of salt use”

Page 7414, Line 14: What is the origin of the stream water? Specify that it matches the sediment collected at each site.

Page 7438, Table 1: Which NLCD year?

Page 7416, Line 18: For how long were samples stored before experimentation?

Page 7417, Line2: Supplier/brand of NaCl?

Page 7417, Line 7: Describe controls as sediment control or sediment-free controls (alternatively, sediment controls and water-only controls). What you refer to above seems to be the experiment, not the controls.

Page 7418, Line 6: Subtract nitrate/nitrite?

Page 7418, Line 17: Keep tenses consistent throughout: “Basically, we used..” changes to “was used” to stay with the subjunctive tense.

Figures: Keep axis titles and keys consistent within and between figures. If you use L-1 (instead of /L) in the axis title, also use that notation for the key and all other figures. Also, indicate the statistical results. Which comparisons are significantly different?

Figure 1: Nice graphic!

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Figure 2: Use Standard Error instead of SD.

Figure 6: Improve these by using 2-digits for R2 values to make the graph less crowded or report R2 in figure caption instead. Specify linear or non-linear correlations (only panel 'a' looks non-linear) and explain this choice in the manuscript. Try a graphing program other than MSExcel to make the figure more attractive or modify the default Excel settings.

Page 7420, Line 10: Indicate if $\pm$ 1.9 is Standard Error or Standard Deviation. Continue indicating this with each $\pm$ throughout.

Page 7420, Line 10: Typo: higheer

Page 7420, Line 20-21: (increase of 1.2 . . . times) or (increased by 1.2. . .. times)

Page 7420, Line 9-10: Indicate that data for calculating the 7.8 times higher DOC values at 4 g Cl/L are not shown since the graphs are for changes in DOC not absolute values.

Figure 2: Indicate outliers with * and then explain this in the figure caption to remove clutter from the graph. What did you do with the outliers? Are they part of the calculations in page 7420 Line 10? Remove the replicate key and put the other key in a more prominent location (for example, above panel a. instead of within it).

Page 7421, Line 3-4: Report results from similar studies in the Discussion instead of the Results section.

Figure 4: Align panel letters.

Page 7421, Line 14: 1.6 times (not time)

Page 7422, Lines 9-21: Because your question is about general relationships of biogeochemical couples, I would suggest you analyze the sites as aggregate rather than looking for site-specific trends.

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Figure 7: Use (n=1) instead of (1).

Page 7423, Line 25: “there were no consistent changes”

Figure 8: Remove second column (Difference) as this is the same data as the first column just presented as a difference instead of the absolute values.

Page 7423, Lines 19-20: If these changes are significant, report the statistics or use “Considerable” instead of “Significant.”

Page 7423, Lines 2-4: Report information about the correlation analyses (type of correlation, all p >0.05).

Page 7426, Lines 11-14: Do the results support this?

Figure 6: Align panel letters (a,c,e).

Figure 6a: Reason for using nonlinear patterns?

Page 7427, Line 9: You mean Figs.4 and 5 instead of Figs. 3 and 4?

Page 7427, Line 22: Figs. 4 and 5

Page 7429, Lines 10-11: “stream sediments and soils” because Figure 5 refers to soils. Though, I am not convinced that there is a general trend of sediment sulfate release; Fig. 4d shows that for 0g Cl/L treatments, sulfate increased in just over half (5/8) of sites.

Figure 9: Good conceptual figure. Try changing black text to white to see if it increases visibility.

Page 7431, Line 21: “our work suggests”

Page 7433, Lines 10-14: Remove text justification.

Page 7437, Line 9: Italicize or underline species.

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Interactive comment on Biogeosciences Discuss., 12, 7411, 2015.