

***Interactive comment on* “From soil water to surface water – how the riparian zone controls the transport of major and trace elements from a boreal forest to a stream” *by* Fredrik Lidman et al.**

Anonymous Referee #2

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General comments

This manuscript follows the idea that riparian zones are mobilization and mediation zones for more than just DOC and nitrate as shown in numerous studies. For that purpose a very good dataset embedded in the Kryckland experimental catchment is utilized. The study shows that indeed a lot of elements are enriched in the riparian zone and partially translates into the stream. However, the way how the manuscript introduces the subject, raises key questions, explains methods and present and discuss result is not sufficient at the moment. On the one hand, the manuscript is repetitive in many parts, circling around the statement of the relevance of the riparian zone without adding much knowledge in the end. On the other hand the manuscript fails to bring

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most things to the point and often lacks a clear structure within the chapters. Methods are not really reproducible and vague in terms of sampling and statistical analyses such as PCA. Own results, results of other studies and discussion are often mixed and hard to distinguish.

Overall, I expected more from this studies: After reading the manuscript I see the point that there are certain elements enriched in the soil/ groundwater of the riparian zone but are left alone with 1) the transfer to the stream and filtering/ mediating processes at the interface that explain differences to the stream water quality and 2) the question if the elements are really enriched in the riparian zone or just more mobile. I know that additional samples are hard to take and to include but modelling (kind of toy modelling as a showcase for dominant processes) would be a potential solution. Taken all this together I cannot support publishing the paper in the present state.

Below, specific comments can be found: Abstract

Page1 L9: I am not fully sure on the definition of riparian zones but I did not know that this includes lakes. Is there a reference for that later on in the text?

Page1 L10: "more or less" is a bit imprecise – please use a better phrase for that

Page1 L12ff: I expect from an abstract to state the problem and shortly describe where and how the study took place. This is not the case here and should be corrected.

Introduction:

Page2 L5ff: What is the difference between water quality in the first sentence and "fluxes of many nutrients, pollutants and other substances" in the second? Isn't it the same?

Page3 L5f: The hypothesis should be sharpened: "it might be possible to identify some of the key processes" is not sufficient. What exactly, based on the literature review above, do you aim at?

Material and Methods:

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The entire section on the study site is a wild mixture of different levels of information. I suggest to restructure this a bit, starting large from the general catchment description (location, climate, land use, hydrology, soils...) to the details of the specific transect.

Fig. 1: This figure suggest that the show catchment actually is the Kryckland catchment. There is enough space to show the nested approach and location within Kryckland. Any other information such as extent of the riparian zone/ soil map would be helpful.

Page3 L18f: Just the transect does not tell you the groundwater flow direction. So, where is this information coming from? Topography? Other wells and head measurements?

Page3 L25f: "probably typical"? Are there references that you may cite for typical soils in this area?

Page3 L26: What is the meaning of "mor" in brackets?

Page3 L32f: I don't understand this sentence.

Page4 L2f: The accumulation of organic carbon is already stated in the introduction. F you want to be more specific on this particular site, give a reference for that.

Page4 L31ff: I have problems to imagine the sampling: You are talking about lysimeters? As far as I know, lysimeters are devices to measure soil water flux/ recharge/ ET quantity? So, how exactly are samples taken? With suction cups? Only in the saturated zone? Please make that clear, provide references or a figure!

Page4 L13: I don't understand this regression. What is the predictor and what the response? And why aren't there just measurements of the heads?

Page5 L23: Is this relationship established by you or published before? This is not clear here.

Page6 L 5: Can you summarize omega here and give the units?

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Page6 L 6f: Please provide mor details on the PCA: Scaling of variables? Rotation? Kaiser critarion for selection of number of components? What data have been used? Mean concentrations or all snapshots in time?

Page 6 L 10ff: I would like to see an introduction to biological uptake in the introduction section. Are there studies which did that before? What about fractionation? Why did you do that at all? For a mass balance of elements or as an independent sample? Please elaborate on that a bit more. Results and discussion

In general I have problems separating the results from this study from previous published material. Moreover, description and discussion are often presented in a mixed form. I suggest to correct this.

Fig. 2: The bottom subplot doesn't show groundwater levels as noted in the caption but hydraulic conductivity. Please correct that.

Table 1: Exhausting information but I see the point showing this data. However, to better capture information I suggest to indicate horizontal (between the profiles) enrichment/ dilution/ chemostasis by additional column and upward, downward, sideward arrows or something like that. What about the temporal scale? Are there changes of concentration over time and where is that shown? You should somehow justify that the mean is a suitable measure of concentration over the year.

Page7 L3f: What do you mean by "stable pH in all profiles of S22"? S22 is one profile with different depths, right?

P7 L8ff: This longer section on Fe speciation is based on other studies only and not on own results? This would make it more suitable for the introduction or a later discussion but not for the result section!

Page7 L 19ff: I cannot find the details on factor loadings and explained variance. You should provide that. Are all nine components fit the Kaiser criterion?

Page 7 L25ff: I would like to see a description of the general results, different factors,

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explainability of different elements instead of directly coming to the deviations and exemptions. In general I miss the outcome and meaning of the performed PCA. PCA is not just a look at the biplot!

Page 13 L1ff: The chapter on the importance of the riparian zone circles around the one key finding of this study: Most elements can be found in higher concentrations in the riparian zone as a function of organic carbon. There is a lot of redundancy with introduction and other part of the result chapter: e.g. the often stated fundamental role of riparian soils for discharge generation and substance mobilization. These parts should be shortened here and the focus shifted to the reason of high element concentrations, weathering, transport...

I tend to say that the inclusion of solid phase samples would make the manuscript much stronger: Are higher concentrations just a function of mobilization in presence of TOC or locally different weathering rate?

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