

Interactive comment on “Assessing the impact of acid rain and forest harvest intensity with the HD-MINTEQ model – Soil chemistry of three Swedish conifer sites from 1880 to 2080” by Eric McGivney et al.

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RE2 = referee 2 ; AU = author's response, (y) = comment no. y

RE2(1): In their manuscript, the authors apply an advanced model, HD-MINTEQ, to model the impact of acid rain and forest harvest intensity on soil acidification, in particular base cation status. Soil acidification is an important global issue that sometimes seems a bit drowned in the attention for soil C cycling but is very relevant indeed. As such the study is of broader interest to the community of SOIL. The study overall

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seems to have been well conducted in a sound, scientific manner and the write-up and presentation is very good. One exception is the figures: because they are effectively a multitude of figures combined in 7 larger ones they are quite small and not always immediately comprehensible. This can relatively easily be amended by reducing some of the figures, or perhaps moving some to the supplementary material.

AU(1): We agree to reducing the number of figures in the main text, so we suggest moving Fig. 1 and Fig. 2 to the Supplement. The figures have been renumbered as a consequence. Multiple panes are required because there are 3 sites being studied, and within these sites, multiple parameters.

RE2(2): While the study in its core is well conducted, there is however one significant issue lacking and that is linking the study to the wider context. As said, soil acidification is a global issue of great importance. However, in their combined results and discussion section, and even their conclusions, the authors limit themselves to describing the results from the studied Swedish sites only. No real attempt is made to place the results in a broader context, or even to extensively discuss them in the context of other work on soil acidification in relation to forest harvest practices. As a result the reader is left to wonder what the significance of it all is. What do the modelling results mean for soil acidification globally?

AU(2): We have included the following text towards the end of the Discussion, immediately before Conclusions: “Although the model was parameterized for three Swedish forest sites, the main trends are likely to be valid also for forest soils in other parts of the world, i.e. that forest management practices are not likely to result in strong acidification effects within one full rotation period. However, these results should not be extrapolated to longer time perspectives, as certain drivers of the model may be increasingly uncertain with time. For example, it is not known to what extent the base cation uptake behavior will differ between NH, CH and WTH scenarios over a period of several rotations.”

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RE2(3): Why is this model better than existing approaches, e.g. the ProdMod and ForSAFE models mentioned in the introduction? Can the HD-MINTEQ model be applied to other forest settings around the globe? If not, what is the remaining knowledge gap to be addressed? Such questions need to be addressed, and this will mean a significant overhaul and extension of the results & discussion (perhaps better to separate both into two sections), and the conclusions. As no new data is needed for this, this should be feasible, but it does mean major revisions, which is therefore my recommendation.

AU(3): ProdMod is not a dynamic acidification model that can be used for this. The advantage of using HD-MINTEQ over ForSAFE is its state-of-the-art descriptions of base cation and aluminium chemistry. This was mentioned already in the first manuscript version, but this has now been further clarified towards the end of the Introduction, in the following sentence: “An advantage of using the HD-MINTEQ model over e.g. ForSAFE and MAGIC is that the former is based on state-of-the-art descriptions of aluminium (Al) and base cation (BC) chemistry, which are probably more accurate (Gustafsson et al., 2018).” As indicated here, these aspects are more fully discussed in a companion paper. As regards the applicability of the model to other forest ecosystems, there is nothing that prevents it from being used also there. The same pros and cons (i.e. the omission of the N chemistry) will be relevant. See also the new text in response to comment no. 2.

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