

Interactive comment on “Increased carbon capture by a silicate-treated forested watershed affected by acid deposition” by Lyla L. Taylor et al.

Lyla L. Taylor et al.

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Reviewer 1: Summary: Taylor et al. present results from an enhanced rock weathering (ERW) field experiment in Hubbard Brook Experimental Forest in the northeastern United States. The authors show observational and modeling evidence in support of sustained carbon dioxide removal for 15 years following the application of silicate minerals to the the experimental plots in 1999. Overall, I find the observational and technical pieces of this manuscript to be very strong. I also found this manuscript difficult to read. I believe the authors could improve the readability, and likely the impact, of the manuscript by revising the structure and flow of the manuscript. Currently, there are an extensive number of equations, missing topic sentences, and redundant sections. These all need to be edited to improve the manuscript. I have tried to highlight some

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examples below.

Response: We agree with the reviewer's comments and agree that the paper will be improved if they are attended to. We are particularly grateful that the reviewer noticed that the text of Sec. 3.3 had been copied into Sec. 3.5, which should contain text related to Figure 5 as we state below.

Reviewer 1: General comments: Please streamline Secs. 2.2.3-2.2.5. After reading them many times, it is still very confusing which equations were used in the modeling, and which are there merely for background context.

Response: We will revisit this text and try to make it more clear.

Reviewer 1: Please use math fonts to better differentiate between text and equations. It is very hard to follow the train of logic in the manuscript, which employs 16 equations, without appropriate fonts.

Response: According to the Biogeosciences guidelines, mathematical variables (other than chemical species) should be displayed in italics and we had not done this. It is not clear which math fonts (if any) are preferred by Biogeosciences, but in any case we are happy to comply.

Reviewer 1: This manuscript would benefit from a table listing all model variables presented in the manuscript with descriptions and units. It is too difficult to keep track of all variables, especially without the use of Math font currently. Also, all model variables need to be used consistently throughout the manuscript. For instance, "X" is used in Eq. 9 and "X_Ca" is used in Eq. 10.

Response: We agree that a table listing the variables in Equations 1 through 14 would be useful. The variables in Equations 15 and 16 are already in an existing table but were not in italics as they should have been given journal guidelines.

Reviewer 1: Please embed figures and tables in the appropriate positions in the manuscript, not at the end. This greatly facilitates comprehension of the non-typeset

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document by reviewers.

Response: We are happy to embed figures within the text if this is still allowed at this stage.

Reviewer 1: Please make arrangements to make the Matlab scripts publicly available, via Github, as a series of supplemental files to the manuscript, or through some other appropriate means. Doing so improves the reproducibility of the science, and allows others to access them without needing to make a “request” (as indicated in the manuscript).

Response: We will make the MATLAB scripts available such that users will not need to contact us. These scripts were not originally intended for public dissemination; they include some existing scripts from earlier work requiring (for example) that extra header lines are added to the publicly available data files. This is less than ideal for anyone wishing to reproduce or extend our analyses, but we will provide a README file explaining these things along with the altered datafiles and the code.

Reviewer 1: This manuscript is missing a study site figure (probably as Fig. 1) that orients readers to the HBEF and the study and control watersheds.

Response: We are happy to add a new Figure 1 showing the study site.

Reviewer 1: Please do not reference equations that have yet to be presented in the manuscript (e.g. Eq. 13, L128).

Response: Agreed. Reviewer 1: Specific comments:

Reviewer 1: There are two Sec 2.1.1: Site description and Treatment description. Please correct.

Response: Yes, the second one should be Sec. 2.1.2 Treatment description

Reviewer 1: Sec 2.1.1 (Site description): Watershed W1 is never introduced. It needs to be intro



per duced here prior to mention of its flow rates (L74)

Response: Watershed 1 was introduced after watershed 6. We have reversed this so watershed 1 is now introduced first.

Reviewer 1: I find the transition between Secs. 2.2 and 2.3 to be difficult to follow. Sec. 2.2 presents the modeling approach and the first sentence in Sec 2.3 begins talking about wood production. Please provide some introductory material in Sec. 2.3 prior to discussing the details of the GHG calculations

Response: The material currently in Sec. 2.3.4 (Greenhouse gas budget for a treatment) should probably be moved to the beginning of Sec. 2.3. With slight alterations it should actually provide the introductory material the reviewer is asking for.

Reviewer 1: Inline calculations (e.g. L195) are very difficult to follow and hinder comprehension. Please consider alternative ways to deliver this information to readers.

Response: The inline calculation can be moved.

Reviewer 1: Secs. 3.2 and 3.3 are essentially sensitivity analyses of the model to different assumptions or scenarios. As such, I think Figs. 2 and 3 could be placed in the SI in order to keep the main figures focused solely on the observational results of the ERW experiment (or model results of the observations)

Response: We are happy to move Figs 2 and 3 to the supplementary information.

Reviewer 1: Sec. 3.5 is identical to Sec. 3.3 (unless I am missing something). Please remove.

Response: We are grateful to the reviewer for catching this mistake. Sec. 3.5 is where the logistical penalties and greenhouse gas balance are discussed but the text seems to have been obliterated during the final stages of editing.

Reviewer 1: Sec 5: This section does not add any new information to the manuscript, especially since key findings were reviewed in Sec. 4. Please remove.

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Response: Agreed.

Reviewer 1: Figs. 1 and 2 are too small to be easily readable. Please enlarge.

Response: Agreed.

Reviewer 1: Figs. 1-3: The dashed lines representing the treatment should be identified in the figure captions.

Response: Agreed.

Reviewer 1: Fig. 4: Is time-integrated CO₂ flux shown on the y-axis (as implied by L 324)? If so, please correct the y-axis label accordingly.

Response: Agreed, the word “flux” should be in the Y axis label.

Reviewer 1: Table 2/Fig. 5: I find the terminology and axis references incredibly confusing. Please use alternate language that more clearly indicates whether the total greenhouse gas budget has increased or decreased.

Response: This table and figure may have been substantially less confusing if the proper text of Sec. 3.5 had been included in the manuscript. Also, re-examination of Fig. 5b suggests it ought to be overhauled to make clear the linkage with Table 2 and also whether the components and total budget are carbon sources or sinks.

Reviewer 1: Fig. 5: missing panel captions (e.g., “a”, “b”, etc.). Also the caption is excessively long and needs to be shortened.

Response: There are several unnecessary sentences in the caption, but on reconsideration we also suggest that Fig 5a and Fig 5b form separate figures (with Fig 5b overhauled as noted above). Panels c and d add little to the story and we think they should be jettisoned. If these things are done then the caption(s) would be considerably shortened and in our opinion less confusing for readers.

Reviewer 1: Fig. 5: I could not find a reference to this figure in the text. Please add a

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reference.

Response: The references to this figure were in the missing text of Sec. 3.5.

Reviewer 1: Figure axis text needs to be enlarged across all figures.

Response: We have appended new versions of all figures in the main manuscript, but are happy to make further changes as required. In particular, we now have a site map as Figure 1, and Figure 5 now has only one panel which is entirely overhauled. It shows the variable names appearing in the old Table 2, Equations 15 and 16, and in the revised text, as well as the meanings of those variables so that the figure is comprehensible without reading the text. We think it is now obvious that the treated watershed is a net greenhouse gas sink. We will nevertheless be happy to revise them again as required.

Please also note the supplement to this comment:

<https://bg.copernicus.org/preprints/bg-2020-288/bg-2020-288-AC1-supplement.pdf>

Interactive comment on Biogeosciences Discuss., <https://doi.org/10.5194/bg-2020-288>, 2020.

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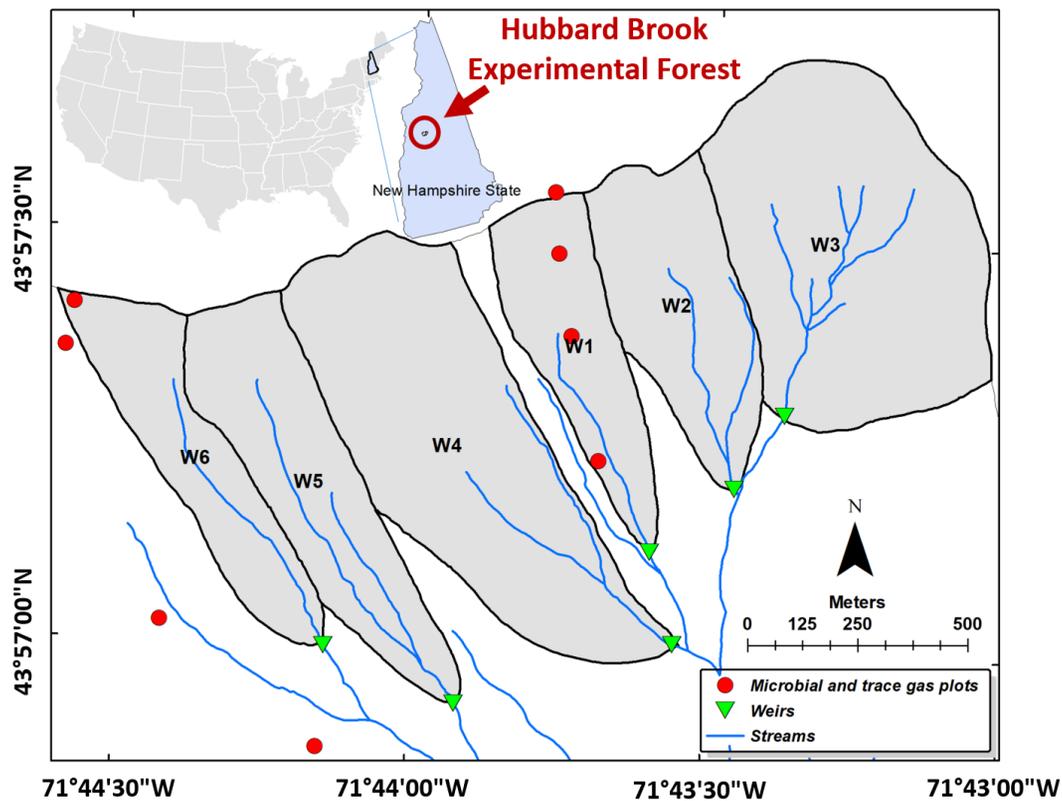


Fig. 1. Location of the sampling sites and the Hubbard Brook Experimental Forest.

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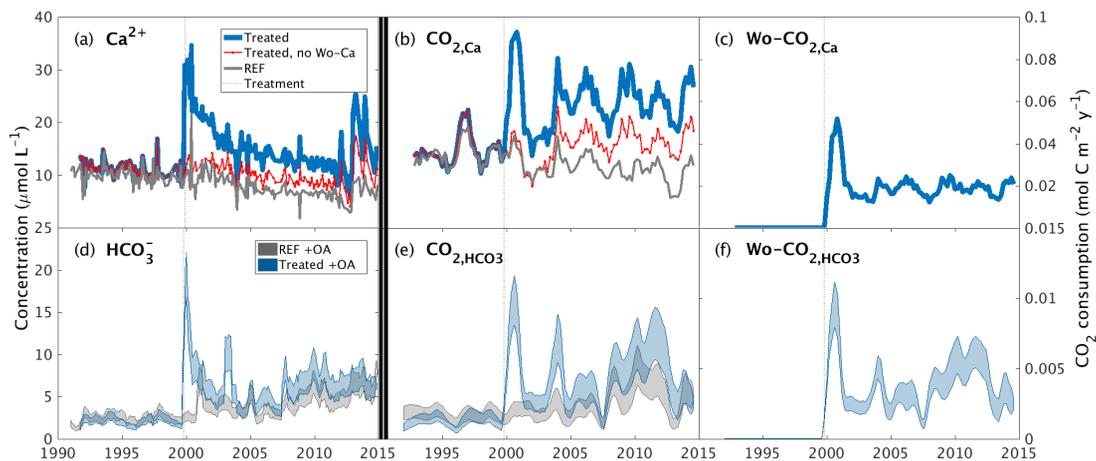


Fig. 2. Inorganic CO_2 capture at the Hubbard Brook Experimental Forest.

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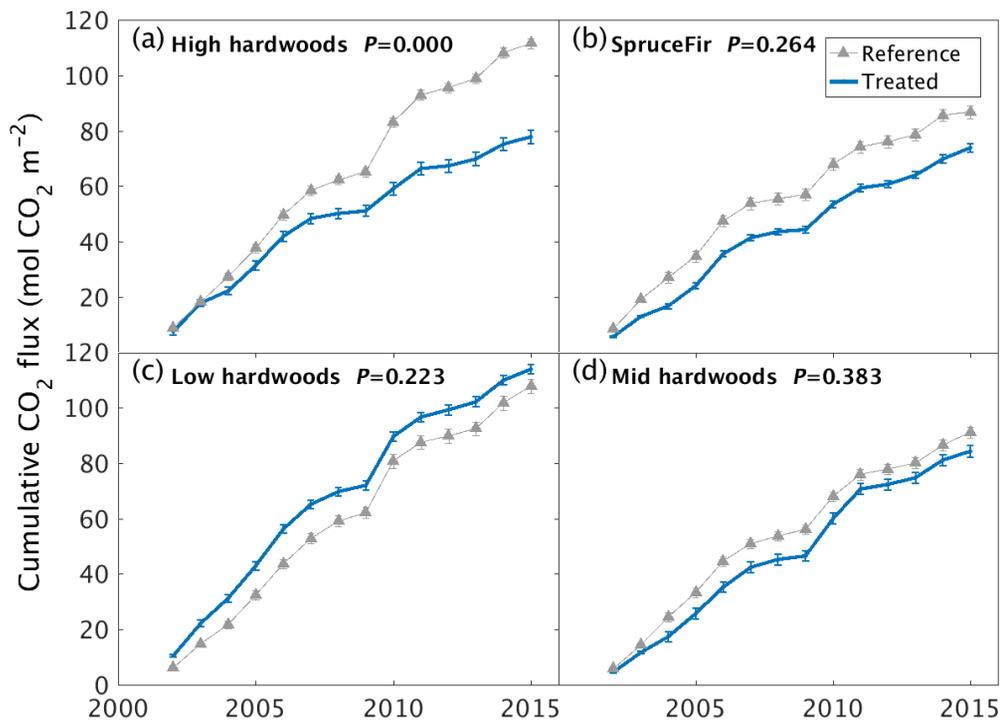


Fig. 3. Long-term soil respiration responses to wollastonite treatment at Hubbard Brook Experimental Forest.

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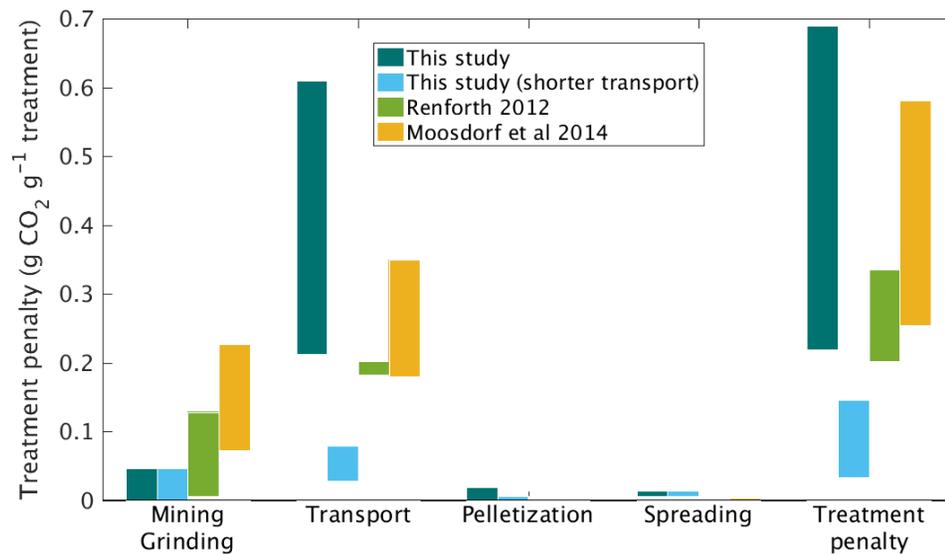


Fig. 4. Carbon penalties for the wollastonite treatment.

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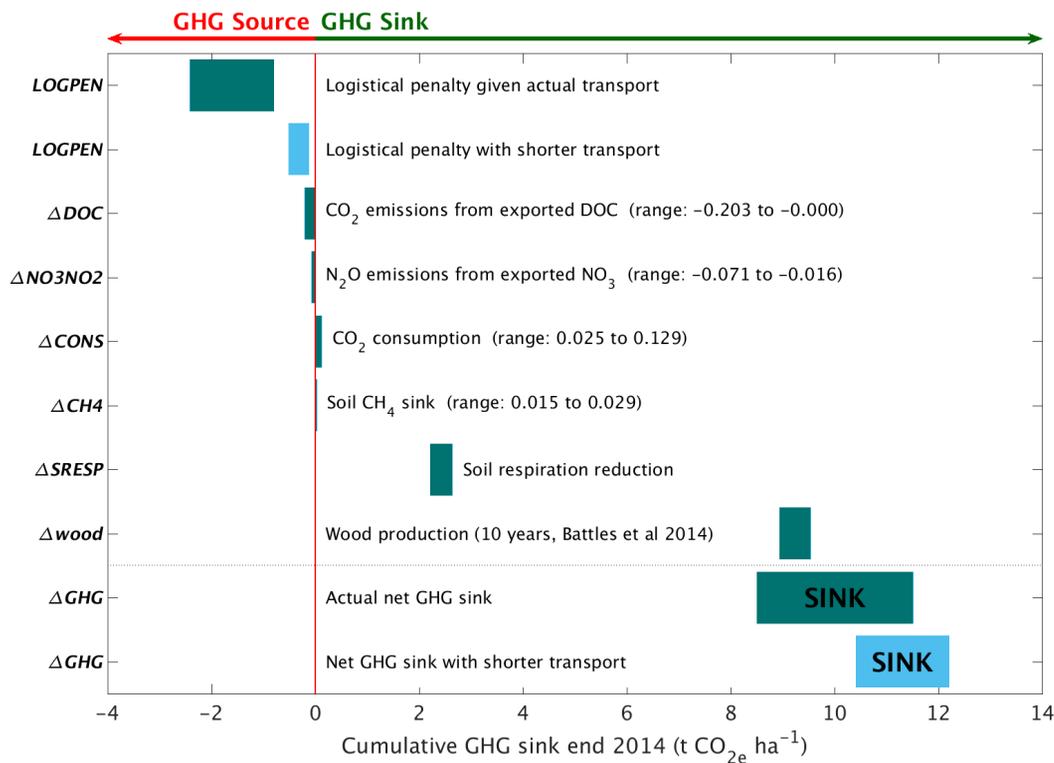


Fig. 5. Carbon responses for the wollastonite treatment.

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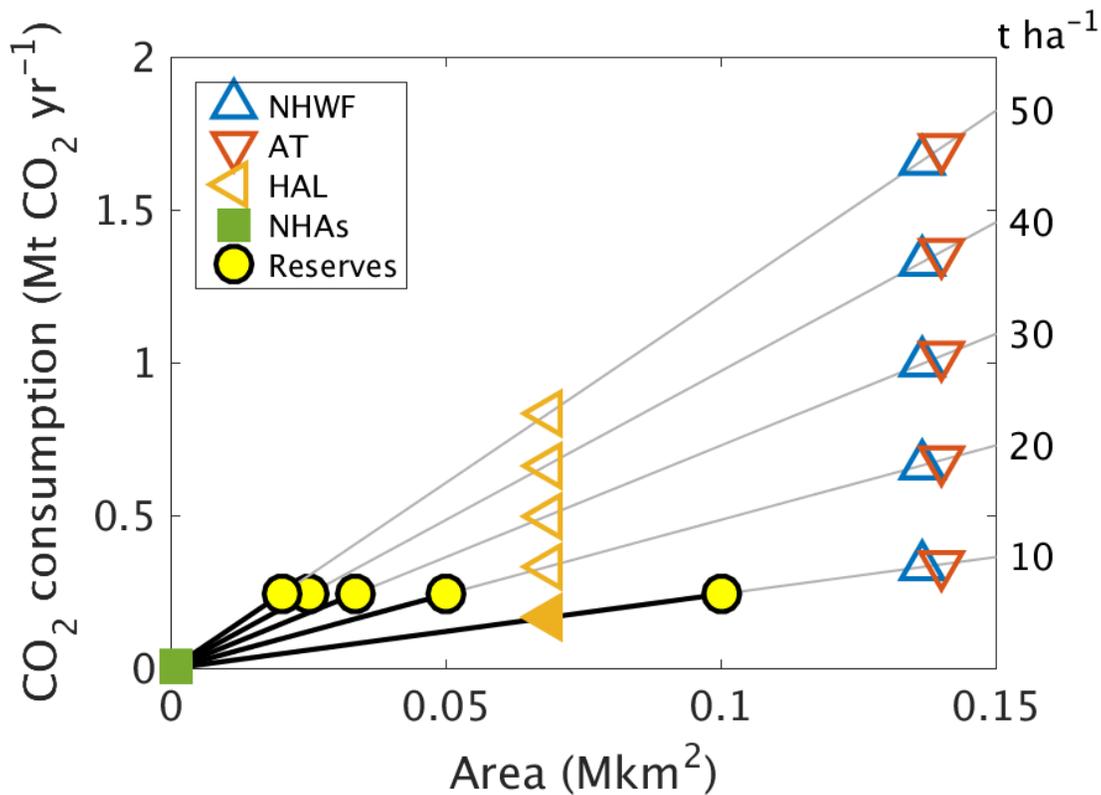


Fig. 6. Projected CO₂ consumption following higher-dosage treatments

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