

# ***Interactive comment on “Bioturbation by wild boar increases the stability of forest soil carbon” by Axel Don et al.***

## **Anonymous Referee #1**

Received and published: 21 May 2019

Review Report

Manuscript Number: bg-2019-113

Full Title: Bioturbation by wild boar increases the stability of forest soil carbon

Summary:

This study investigates the effect of simulated bioturbation by wild boar on forest soil carbon stocks and on soil C stability. Bioturbation was simulated by artificial soil disturbance down to the mineral soil. Total soil carbon stocks did not change after six years of regular soil disturbance. However, a major part of the litter layer carbon was incorporated into the mineral soil due to bioturbation. Accordingly, litter layer carbon stocks decreased and mineral soil carbon stocks increased following bioturbation. Moreover,

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mineral-associated carbon increased due to soil disturbance. The authors suggest that mineral soils were not carbon saturated and have an unused capacity to stabilize and store more carbon. In conclusion, the authors claim that wild boar bioturbation may enhance (speed up) carbon stabilization in the mineral soil.

General comments:

Overall, I think this is a very nice study. Wild boar populations are increasing across Europe and their effects on soil carbon dynamics are still not fully understood. The manuscript is well written, the study design and measurements are sound and the results are interpreted in a good way. However, I have a number of concerns regarding the sampling procedure, the statistical analysis, and some of the figures. Please, find my specific comments in the following. I think after a revision the manuscript will make a valuable contribution to the research field and should be considered for publication in Biogeosciences.

Specific comments:

Title:

In my opinion, it should be added to the title that wild boar bioturbation was actually simulated.

Abstract:

P 1, L 7: Please rephrase 'can help'.

P 1, L 9: Add that wild boar bioturbation was simulated.

P 1, L 17: Please rephrase 'can help'.

Introduction:

P 1, L 30: I suggest either to replace 'the main process' by 'a major process' or to add an appropriate reference to that statement.

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P 3, L 2: Please add the references of the studies which have investigated wild boar effects on soil carbon stocks.

P 3, L 11: Add that the effects of ‘simulated’ wild boar grubbing were investigated.

## Materials and Methods

P 3, L 16, 17: I think there should be an ‘a’ before mean annual temperature and moisture.

P 4, L 14-19: It took me a while to understand the idea behind mass equivalent sampling, and why you applied it in this study. However, I’m still not sure if I properly understand it and I’m therefore a bit concerned if this procedure might affect the results. By sampling the same amount of soil per horizon and pit, I have the feeling you could underestimate potential C losses from bioturbation. For example, in the theoretical case, 50% of the LF horizon organic matter stocks would have been mineralized due to bioturbation, this sampling procedure would artificially ‘refill’ the missing amount of organic matter with organic matter from the next horizon (i.e. O horizon). Now, the O horizon is (artificially) smaller, but will be ‘refilled’ with soil from the next layer, and so on. At some point, material from a deeper layer which has not been sampled at the reference plot would be sampled to ‘refill’ the missing amount of organic matter. Thus, the actual amount of lost C would be underestimated. I might be completely wrong, but then I suggest to elaborate more in detail on the sampling procedure.

P 5, L 1-2: Was there only one composite sample per site, treatment and soil horizon? Please clarify.

P 5, L 14: Which statistical test did you use? What was your level of significance? How did you account for nesting within sites? Please clarify. Results

P 5, L 17: Again, please indicate that bioturbation was simulated (here and elsewhere in the text).

P 5, L 18: Fig. 2a not 2A.

P 5, L 23: In my opinion it is not necessary to show the results of the individual plots. Thus I would suggest to move Fig. 3 to the supplements.

P 6, L 4: Instead of showing the individual plots (Fig. 3) I suggest to add a figure showing the bioturbation effect separate for the forest types.

P 6, L 8-10: This should be part of the discussion.

P 6, L 14: It is stated earlier that fractions were determined on composite samples only. How did you do statistics on that? Please clarify.

P6, L 15: Clarify that 'treatment effects' were similar among forest types. In the present form I first thought that e.g. POM fractions were similar among forest types.

P 6, L 19: is 'total stocks of MOM' correct? Or should it be MOM fraction? This reads a bit confusing. I would also suggest to refer to Fig. 4a here.

P 6, L 23-24: Please add the forest floor POM/SOM proportion and stocks to Figure 4. Although this results are included in Fig. 5, I think it would be more clear if you add it to Fig. 4.

P 7, L 4: Was there no mineral surface C in the forest floor of the reference plots? Did you measure it? Please clarify.

Discussion:

P 8, L 30: I guess it should be Fig. 2b not 1b.

P 9, L 10: Please cross-check figure reference.

Conclusion

P 10, L 16: Please, add that wild boar activity was simulated.

To put your results into a bigger context, I suggest to add some information/thoughts about potential long-term consequences.

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Figures:

Figure 2: In the case horizons showed significant differences between treatments please indicate that by adding significance stars to the figure.

Figure 3: This figure should be moved to the supplements. Instead replace it with a barchart for each forest type. Add significance stars to the figure.

Figure 7: In the case horizons showed significant differences between treatments, please indicate that by adding significance stars to the figure. What happened to L+O of the reference plots?

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