

Interactive comment on “Carbon losses from pyrolysed and original wood in a forest soil under natural and increased N deposition” by B. Maestrini et al.

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Received and published: 21 May 2014

I was glad to see this paper. Around the time you submitted your paper, colleagues and I published a review of PyOM (biochar) stability that you might find useful to cite (Gurwick et al. 2013. DOI: 10.1371/journal.pone.0075932).

For example, in your introduction you nicely summarize the different approaches that the few available field experiments have taken. In our paper, we looked for all published field experiments that had quantitatively assessed biochar stability and synthesized the approaches and findings of these experiments. Your study is more rigorous than many, and our synthesis provides a useful springboard from which to highlight your

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contribution. We found only 7 field experiments (published through the end of 2011 and summarized in our Table 1) with estimated turnover times ranging from 8 to almost 4000 years. Your paper provides a valuable additional data point to this synthesis, and you might consider pointing that out in the discussion. In addition, by measuring loss as CO₂ directly and using the ¹³C label, your study avoids the problem of distinguishing between C loss from mineralization and C loss from physical transport. From the point of view of terrestrial C storage, this distinction matters a great deal, and it is absent from a number of studies that claim to measure biochar stability.

Similarly, your discussion includes an illuminating comparison of MRTs from your study with those from other investigators. For example: “The PyOM mean residence time calculated here is closer to the values reported by Nguyen et al. (2008), who found a mean residence time of 264 yr under tropical climate and from Hammes et al. (2008) who found a mean residence time of 347 yr in a boreal steppe, indicating that irrespective of the climate, the quantification method and the length of the experiment PyOM has a mean residence time ranging in the centennials, when measured in field conditions.” Here again I wonder if referencing Table 1 from our paper, which concisely synthesizes many of these figures, could be helpful.

“Due to its aromatic structure, PyOM has been hypothesized to be particularly resistant to microbial decomposition (Schmidt and Noack, 2000) and have a centennial mean residence time (Schmidt et al., 2011; Singh et al., 2012).” Some claim hundreds to thousands of years. Your study weighs in more on the hundreds. Setting out the larger range of claims in the introduction could help show how your study adds weight to one part of this range rather than another.

“However, only a few field experiments have been conducted. . .” As noted above, we looked for all field experiments we could find in the published literature and synthesized their results, providing a useful springboard for this study and discussion.

In addition, even with the more complete and illuminating measurements you report,

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there are additional factors that need to be taken into account in assessing the potential effects or benefits of PyOM additions to soil. How these effects are taken into account might depend upon whether the source of PyOM is naturally-occurring fires or deliberate PyOM production in kilns. We addressed these decisions in the latter context, and it could be instructive to make this distinction more explicit in your discussion.

“Singh et al. (2012) reviewed PyOM mean residence time by compiling a database with results from studies using different experimental designs. One clear message was that PyOM mean residence time was longer in field studies than in incubation studies, but the reason for that could not be reduced to one single factor.” In our paper, we also include a supplementary table that categorizes field studies of PyOM by topic. Given the very cogent review of previous studies in your introduction, our table might also be of use/interest to your readers.

What additional information/data would be needed to drive a full Life Cycle Analysis of the influence of biochar on GHG budgets? Do you have any thoughts on whether your study (perhaps in combination with others like it) and other available, robust information would capture most of an LCA?

You compare the wood decomposition rate and the PyOM decomposition rate (p. 13, lines 15-20 and at the top of p. 14). If you were to add C loss during the production of PyOM to the PyOM decomposition rate, then how long would it take for C loss from PyOM production + PyOM decomposition to equal C loss from wood decomposition? I raise this question because from the atmosphere’s point of view, C loss from pyrolysis is as important as C loss later on. In fact, a pulse of C loss leads to more heat-trapping sooner, compared to more gradual C loss. So somehow pointing out that the PyOM already represents a large C loss helps to place the comparison of wood decomposition and PyOM decomposition in an appropriate systems context. This is also relevant to p.16 paragraph 1.

Do other studies suggest that priming would be more important in any other settings

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vs. the low/minimal priming rates you observed?

On the absence of measurements during winter, you might refer to work by Groffman, for example, on patterns of soil trace gas fluxes from forest soils during the winter.

“accepted if r of the regression line was higher than 0.9, if $r^2 < 0.9$ the data were. . .” Is it r or r^2 ?

Regarding this paragraph: “The PyOM mineralization rate did not decrease significantly with time (Fig. 3). . .” and the paragraph that follows it, I’m glad to see you address the question of changing decomposition rates over time. It could be helpful to add one qualifying sentence acknowledging that because you report results from only the first year of the study, it’s possible that decomposition rates will decrease over longer time scales.

There are a few places where word choice led me to stumble. For example, “did not allow concluding on the” – I would have written “did not allow conclusions about the. . .” You might consider giving the text a fresh read-through to catch points like this.

Again, I congratulate you on this study and very much appreciate the way you describe the status of knowledge along several different axes in the introduction.

Interactive comment on Biogeosciences Discuss., 11, 1, 2014.

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