

Interactive comment on “Black (pyrogenic) carbon in boreal forests: a synthesis of current knowledge and uncertainties” by C. M. Preston and M. W. I. Schmidt

Anonymous Referee #1

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Comments on the paper 'Black (pyrogenic) carbon in boreal forests: a synthesis of current knowledge and uncertainties' by C. Preston and M.W.I. Schmidt

General comments The paper spans a wide range of topics and reviews quantification, production, characteristics/stocks, mechanisms of loss of black carbon, and the cycle of black (pyrogenic) carbon in boreal forest regions. It is thus of interest for a broader scientific audience. Each particular chapter is well-written and worthwhile reading, but the overall impression is that the paper is not focused. The missing focus is most obvious when the title is compared to the text: Only chapters #5.3.1 ('Qualitative characterization of PyC in forest soils') and #7 ('The PyC cycle in boreal forest regions') are specifically designated to boreal PyC, while others (#5.1 'General effects of fire on SOM properties') reiterate recent reviews on BC or miss a direct relation to the topic (#5.2

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on agricultural and grassland soils, #5.4 'BC in marine sediments'). To give another example: Chapter #6 on 'Mechanisms of PyC loss' does not address PyC in boreal forests, but includes 'Degradation of geological and sedimentary substrates'. Though important mechanisms are discussed here, this section would better be published as a stand-alone paper rather than being part of the review. Suggestions to make the paper acceptable for publication in Biogeosciences mainly include partitioning into at least two papers of which one should specifically address the topic as quoted in the title, while the other could deal with general mechanisms of PyC production and loss in different environments. A paper on BC in boreal forests could, for example, synthesise the findings on annual rates on BC production, loss, stocks, and their uncertainties. I am unfortunately forced to decline the paper in its current form.

Specific comments

Abstract: How does the figure on boreal BC compare to global estimates?

Chapter #3 'Quantitative analysis of PyC': Methods are listed at the beginning and should be referenced.

P. 218, l. 26. What is the time horizon of that rate (within 100 years, 500 t BC ha⁻¹ would accumulate)?

P. 219, l. 24. How was BC measured in the study of Muri et al. (2002)?

Chapter 4.2. A table summarizing aerosol emissions and emission factors would be helpful. The first sentence is redundant and contradicts the length of the chapter. Most of the text on page 220 can be omitted. A clear definition of 'volatile' and 'aerosol' in the context of BC would be helpful for non-atmospheric scientists.

P. 221, l. 14. Is this a global estimate?

P. 222, l. 9. What is meant by 'climatological mean' (in the context of four years!)?

Chapter #5.1. The authors cite two recent reviews dealing with fire effects on SOM. Is

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this chapter really necessary?

P. 231, l. 11. A reference must be given for the Australian study.

Rates of BC production upon forest fires are listed in Table 1 and include not only boreal, but also (sub)tropical sites. This is interesting, but outside the scope of the study. The comparison shows that 'mean' rates in the tropics exceed those in colder regions. Is there any explanation for this?

Chapter #6.1. The first two sentences are a reiteration of previous sections and thus redundant.

P. 233, l. 23-26. This sentence on graphite incubation can be moved to chapter#6.2.

Chapter #6.4. The first part of this chapter would better be part of #6.1.

P. 237. This section is not related to PyC in boreal forests at all. Could be part of a general review.

Chapter #7.1, first paragraph. It would be worthwhile comparing the calculated charcoal production rates, charcoal consumption rates, and current BC stocks in soil to check whether the various assumptions/measurements are consistent (budgeting).

Pages 238-239. The many estimates on annual emission rates could be presented in tabular form.

Chapter #7.3. The text on page 241 is more on 'Does vegetation fire influence boreal forest soil function' rather than on 'Does charcoal influence'. Probably, the title could be adopted accordingly.

P. 242, l. 17. The difference between charcoal from wildfire and activated charcoal should be specified.

Figure 3 looks convincing, but the authors should provide references for the atomic ratios of the compound classes. It is not sufficient to state that these ratios are 'typically

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measured in geochemical studies' (page 216, l. 12).

Figure 7 does not show some of the data discussed with respect to it at the beginning of chapter 8 (fuel conversion rate 1-3%, conversion to volatile soot 0.1-0.4%) and is thus incomplete. Also pool sizes are not given. I suggest skipping it because it provides no additional information.

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