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Interactive comment on "Distribution of black carbon in Ponderosa pine litter and soils following the High Park wildfire" *by* C. M. Boot et al.

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1) Assumption of this study: The major constraint to compare the BC stocks in the litter/soil of the unburned sites with a fire history and recently burnt site is that we do not have any knowledge of the production rate of BC in these two sites after wildfire. Therefore, there is high uncertainity with respect to loss of BC or incorporation into the soils. The assumptions made in this study and various constraint should be highlighted.

This study focused on processes contributing to the distribution of BC in soils after it was deposited on the forest floor, and does not address the amount of BC produced in the fire. Different amounts could be deposited from different fires depending on the type of fire, and climate post-fire, however in our discussion of incorporation of BC into soils we explicitly state, "This calculation contains a high degree of uncertainty. . ." (p.

16813), and have added text that the incorporation rates will also depend on characteristics of the fire (p. 16813).

2) Loss of BC: The presence of BPCA-C in the litter of unburned site indicates fire history. The data indicated that recently burnt sites litter have higher BPCA-C as compared to the unburned sites leading the authors to conclude that erosion is the dominant loss mechanism. As mentioned by the authors, the return interval of fire in this site is 40-100 years, it is possible the BC was lost not only via erosion but also through leaching, degradation leading to mineralization/decomposition both biotically as well as abiotically. The authors should discuss in detail why erosion is the most dominant loss mechanism for this ecosystem and if it is specific to this site. Are there any other study that highlight erosion as one of the prevalent process for this specific site?

We have added text that addresses this comment, expanding the discussion of loss mechanisms (pg 16813, new paragraph for loss mechanisms following discussion of potential rate of incorporation), and referenced preliminary data discussing the contribution of erosion on BC contents in the CLP, as well as a reference that describes particulate black carbon export from the CLP following the HPF (Wagner et al. 2015).

3) Burn intensity and BPCAs: Could authors provide any detail regarding the temperature range for the wildfire. Does the moderate and high intensity also had differences in the temperature of the wildfire? This is important because the gradient of change in structure between say 300 and 600 degrees is very steep, so a small change in temperature can induce a large change in BC structure and hence differences in the relative proportions of BPCAs in different burn intensity sites.

Unfortunately, we had no data on the temperature range of this wildfire. There was no difference in the proportion of B6CA or the B5CA:B6CA ratio between the moderate and highly burned sites (see table S5 where layer is the only significant effect). The discussion of temperature and the BPCA patterns has been expanded to include the effects that were observed by layer (p. 16814).

4) BPCA and age of BC: A word of caution when drawing conclusions from the ratios of B5CA and B6CA to the age of BC. There are studies that indicate no change (Schneider et al., 2011) or an increase in B6CA (Hammes et al., 2008) after 100 y or decrease in total aryl group indicating decrease in B6CA (Hilscher and Knicker, 2011). BC with very high proportion of B6CA could also come from high temperature freshly burnt charcoal. It is not clear yet if the changes in the relative contribution of various BPCAs could be linked directly to age of BC. Please clarify what does this ratio implies.

The discussion has been modified to remove conclusions about B5CA:B6CA and BC age, and has been refocused on a discussion of temperature of formation.

5) BPCA pattern of fresh BC produced after wildfire: The type of BC produced during the wildfire in this particular study has not been made very clear. Did litter layer in moderately burned sites majorly constituted of charred needles while high burn intensity sites also had some wood charcoal or the type of BC produced were similar? This is important as BC produced would be qualitatively different and hence would have a difference in BPCA pattern. Did authors also measured BPCA of the BC produced (only charcoal pieces and not litter in general)? This is important to compare the BC produced and the processing it underwent while getting incorporated into soil layers.

We described the sites, “Areas were classified as high burn when the fire had burned the entire tree and no needles or small branches remained. Moderate burn areas had ground fire and some crown scorch, but crowns did not burn and at least some needles remained on the trees. Unburned areas had no evidence of ground fire and no evidence of burned material on the ground surface.” The types of BC produced were similar in the highly and moderately burned sites. There were standing, and a few charred logs in both the moderate and highly burned sites, but they were not sampled as part of the soil collection effort, the samples that were collected were as described, “The litter layer was sampled first and then the soil excavated with the help of a hand shovel separately for the 0-5 cm and 5-15 cm depth. Due to the high surface variability, 4 additional litter samples and 3 surface (0-5cm) soil samples were collected at each

site, positioning the frame orthogonally to a distance of 2.5 m from the original position. All litter and surface soil samples were pooled by plot.”

6) The data in this study indicated that the stocks of BC in unburned sites and highly burned sites are similar, however, they are distributed differently. It is obvious to have higher BC stocks in the litter layer of the high burn intensity sites compared to unburned sites after wildfire. However, what could be the reasons for lower BC stocks in soils of high burn intensity as compared to unburned sites? Discuss.

BC stocks were not significantly lower in the high burn intensity than unburned sites (see Table S4). The paragraph that discusses this (p. 16812) opens with the idea that burned soils can have lower BC stocks due to combustion of relict BC during recent fires, however we did not we did not find this trend in our system.

7) Validation of BPCA method should be addressed in method section rather than in results as the method was not developed in this study but adopted from previous stuides based on BPCA analysis. Moreover, Methods and material section could be shorten with proper referencing of the method used.

The methods section was shortened and the BPCA method validation was moved to the supplemental information.

Minor corrections

BPCA is molecular marker and not biomarker. Please correct it throughout the manuscript.

It has been corrected.

P16800 L10-remove developed and, "We developed and implemented the benzene polycarboxylic acid (BPCA) method"

It has been removed.

P16800 L12: abbreviate black carbon P16800 L25: add " one of the least" P16801 L3:

"BC" instead of Black C P16803 L7: it should be either BC or BPCA-C and not BPC-A

Suggested changes have been made.

P16803 L9-10: rephrase the sentence "We also expected that the BC age and degree of processing would increase with depth" . The manuscript does not highlight how BC age was calculated. Instead of degree of processing it should be degree of condensation.

We have made this change.

P16803 L24: HPF was abbreviated here. It should be stated when first used, for eg. in the abstract (P16800 L 4). Be consistent while using abbreviated terms once defined.

We have made this change.

P16813 L9-11: The authors calculated based on this study that 17% of the HPF fire-derived BC in litter would be transferred to the 0–15 cm soil and concluded that the bulk of the BC in this system likely moves off the landscape through surface runoff. How was this conclusion drawn is unclear. Again, the loss of BC could occur via several other mechanisms including runoffs. This conclusion should be stated as one of the possibilities rather than a clear mechanism occurring in this specific site.

We have added text that addresses this comment, expanding the discussion of loss mechanisms (pg 16813, new paragraph for loss mechanisms following discussion of potential rate of incorporation), and referenced preliminary data discussing the contribution of erosion on BC contents in the CLP, as well as a reference that describes particulate black carbon export from the CLP following the HPF (Wagner et al. 2015).

P16813 L13: what does biotic infliteration processes refers here? Please clarify.

We have added the phrase, ‘stimulated by soil fauna’ to clarify the meaning of biotic infiltration.

Conclusion: This section here is rather a highlight and appears incomplete. It should

include major findings and its implications. The authors should stress on the distribution pattern of BC in different soil layers after wildfire as the major conclusion rather than the loss mechanisms which remain unclear.

The ‘conclusions heading’ should have been at the beginning of the previous paragraph, and the paragraph has been re-written as suggested.

Interactive comment on Biogeosciences Discuss., 11, 16799, 2014.