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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.

Anonymous Referee #4

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This paper examines the effect of burn intensity and slope in the stocks and content of carbon (C), nitrogen (N) and black carbon (BC) after wildfire. The method used to measure BC is suitable. The topic is interesting and is appropriate for the journal Biogeoscience. However the manuscript requires some revisions, specially on the discussion part.

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.

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?

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.

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.

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.

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.

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.

Minor corrections

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

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

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

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.

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.

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.

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

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.

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