

## ***Interactive comment on “Thermal alteration of soil organic matter properties: a systematic study to infer response of Sierra Nevada climosequence soils to forest fires” by S. N. Araya et al.***

### **Anonymous Referee #1**

Received and published: 25 September 2016

General comments: Araya et al. present much-needed information about the type and extent of changes to soil properties across a range of heating temperatures, for soils collected from the Sierra Nevada, which is an area of great interest in light of the potential for these mixed-conifer forests to experience major changes in fire disturbance regime. The results are interesting and important because they present changes in soil and SOM during heating when oxygen is somewhat present, as occurs during natural fires. Their results especially provide an interesting comparison to recent research emphasis on heating soils in oxygen-limited environments, which have focused on quantifying and characterizing pyrogenic C. Their finding that most of the C and N of higher altitude soils became associated with the silt/clay sized fractions at 450C is interesting

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and important because this fine fraction may become more susceptible to loss via erosion. Therefore, their results suggest that if fire temperatures increase, forest C would take a double hit by experiencing immediate (heat-induced) C loss as well as delayed (via erosion) C loss. The authors first begin describing OM “quality and quantity” in the Discussion, so a brief statement much earlier in the manuscript is needed to introduce and identify the metrics the authors are using to assess SOM quality. My major critique is that the authors have not presented the full results of their statistical tests, yet they discuss increases, decreases and correlations. This manuscript is well-organized, has good focus, and is generally well-written, however, additional editing for English language is needed, particularly in the Discussion (many of missing articles; misuse of “while” instead of the correct “whereas” when making contrasts; disagreement in verb use and plurality).

Specific comments and technical corrections: Abstract: L2: Can you revise the first statement to provide a more engaging beginning to your manuscript? L3: Remove capitalization on Climosequence; specify laboratory heating experiment L10-13: confusing/clarify Many places: “increase” should be “increased” so check English language usage throughout msctpt

Introduction: L8: such as? L5 and elsewhere in the manuscript: I think you should remove self-citation of the information you are presenting in the current article for review, even in “published” previously as a Discussion article. However, I will defer to the Editor’s recommendation on this issue. L7: it determines in part (not exclusively!). Also, replace “longer durations” with “longer residence time” or “durations at a particular location” L8-9: this statement is confusing because you’re comparing duration, temperature and rate of spread. I personally understand what you’re trying to say but it is not clear as currently written. Clarify this statement. L18-20: clarify awkward statement. L22: “used” L23-P5L3: English language needs revision in objectives statements. E.g., “to determine (2) identify” and “to determine (3) infer” does not make sense. Just move the “determine” to after the (1) to fix the problem here.

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Methods: L11: grassland sites also experience fires in this region L13: complete citation or remove duplicate P6L3-11: clarify in the text that Vista, Musick, etc. soils are soil Series names. Also, what do you mean by “soils receive the highest biomass”? From what do they receive biomass? Do you mean they support the greatest aboveground biomass and receive the greatest annual litterfall? Are you talking about aboveground biomass or microbial biomass? Please clarify. P7L2: Were O horizon(s) included in your samples, or did you first remove the overlying O horizons to collect only the 0-5cm depth of the mineral soils? This is very important to clarify your sampling approach here. P7L23: clarify here what part of the soil ignites at 220C P8L5: yes, but the duration of heating experienced by soils during fires in the environment is typically very short (just a few seconds) except where the soils are overlain by a lot of fuels that have potential to provide sustained heating into the mineral soil P9L3: “by adjusting” P9L11-22: add description about what was used as the background spectrum, and the approach used for scaling and baseline adjustments, etc.

Results: P13L12: reference error. Also, consider replacing “combustion” with “contrasting levels of thermal treatments” Where are the results from the statistical tests? Letters are indicated on Figure 2, but nowhere are F or p-values reported for any of the tests. Correlation coefficients are reported in Table 3, but without associated p-values. Except for a few places, the results text also does not state whether the observed “differences” are statistically significant or not. Much more detail is needed about the statistical results to be able to adequately interpret the significance of the author’s observed patterns. Report the full results (all coefficients) from the simple linear regressions.

Discussion: P14, L5: Here the authors state “significant effects” but have not provided sufficient detail about the results of their full set of analyses. P15, L23-P16, L1: Here it is not clear whether you are talking about the combustion of specific types of organic compounds (lipids versus cellulose and lignin) or combustion of types of materials ( X? versus woody materials). Please revise to make your meaning more clear.

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P16, L14: Revise: awkward sentence L17: observed L24: revise punctuation to: "...heating intensity; that is, lower..." L23-P16,L3: I don't follow your meaning here. Also, it's unclear whether this information refers to heat intensity or fire (fireline) intensity. Relating intensity to slowness of a process is a questionable analogy. Check sources and revise language to clarify your meaning. P18,L15: replace "most significant" with "greatest" (especially because all the statistical results have not been reported in this version). P18, L18: revise to clarify your meaning, or omit "below". L23: omit the parenthetical clause because it is redundant with the information that follows. P19, L20: I don't think that 2% to 8% C can be called organic-matter rich (they are only relatively rich in SOM, compared to subsoils). Omit this part of the sentence. P20, L13: replace "got" with "was" or "became"

Figures: Figure1: Assign letters to figure panels. Revise caption to state which panel shows the basemap of tree canopy cover. Figure 2: Very nice figure that shows clear trends across the temperature treatments. Figure 3: Revise to agree with the format used for Figure 2: show only one set of column labels and one set of x-axis labels to be able to increase the size of the panels. Currently it is much too small to read. Move the legend symbols into the figure caption for better use of space. Figure 5: Provide more detail in figure caption, for example, state that heating temperature is shown to the right of each spectrum Figure 6: Increase the font size used for axis labels and axis titles. Statistical results?

Tables: Table 3: add p-values for all correlation coefficients.

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