

## ***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.***

**S. N. Araya et al.**

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*The referee comments are followed by our responses. We have indicated location of texts in the manuscript by a combination of page number and line number.*

### **General Comments**

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.

**Author response:** We have added statements earlier in the manuscript that describe the metrics of SOM quality assessments. We added a sentence in the introduction (P4,

L232-4). We also added a brief description of the methods, including SOM quality, in the Materials and Methods section (P5, L7-14)

My major critique is that the authors have not presented the full results of their statistical tests, yet they discuss increases, decreases and correlations.

**Author response:** We have decided to include the full results of statistical tests as an appendix to the manuscript. In addition, we have indicated p-value for correlation coefficients ( $r^2$ ) reported in Table 3.

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).

**Author response:** We have reviewed the entire manuscript, particularly the discussion section, for language and have made several grammar changes. We thank the reviewer for the many language corrections they have provided us.

### Specific comments and technical corrections

P2, L2: Can you revise the first statement to provide a more engaging beginning to your manuscript?

**Author response:** We have revised the introduction section for clarity and to address the reviewer’s comment.

P2, L3 (5): Remove capitalization on Climosequence; specify laboratory heating experiment.

**Author response:** We have corrected the capitalization as suggested. We have also re-written the sentence to specify laboratory heating experiment (P2, L3-6).

P2, L10-13: confusing/clarify Many places: “increase” should be “increased” so check English language usage throughout manuscript.

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**Author response:** We have re-written the sentences in order to clarify (P2, L14-15). We have also revised all instances of “increase” and “increased” throughout the manuscript for grammar.

P3, L8: such as?

**Author response:** We have added a sentence with examples (P3, L7-9).

P4, L5(2) 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.

**Author response:** The citation in question (Araya et al. 2016) is from a separate publication which has some important data on physical and chemical changes that result from heating.

P4, L7: it determines in part (not exclusively!). Also, replace “longer durations” with “longer residence time” or “durations at a particular location”

**Author response:** We have amended the wording of the sentence to clarify the meaning as suggested (P4, L6).

P4, L8-9 (4-6): 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.

**Author response:** We have re-written the sentence to clarify the statement (P4, L 6-8).

P4, L18-20 (15-17): clarify awkward statement.

**Author response:** We have corrected the paragraph (P4, L17-18).

P4, L22 (19): “used”

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**Author response:** We have corrected the word as suggested.

P4, L23 (19)-P5, L3: 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.

**Author response:** We have corrected the section as suggested (P4, L24).

P5, L11 (9-10): grassland sites also experience fires in this region

**Author response:** This statement was meant to highlight that the grassland site is not likely to experience burn temperatures at the high temperatures (>350 C) and at the residence times (30 min) that we used in this study. But, we do understand the reviewer’s concern, and for the sake of clarity, we have removed “for comparison” from that sentence.

P5, L13: complete citation or remove duplicate

**Author response:** we have removed the duplicate citation.

P6, L3-11: 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.

**Author response:** We have adjusted the paragraph. We have indicated that soil names are soil Series names. We have also clarified the phrase “highest biomass” to mean highest litterfall (P6, L 15-18).

P7, L2: 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.

**Author response:** We have added a sentence to indicate that O horizon was removed

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prior to sampling (P7, L 10-11).

P7, L23: clarify here what part of the soil ignites at 220C

**Author response:** Explicitly, the soil organic matter ignites. However, since it is part of the soil, we feel the general statement is sufficient (P7, L24).

P8, L5: 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.

**Author response:** We agree with the reviewer here. In deed this is why we decided not to prescribe heating times, and treat all the soils to the same heating time.

P9, L3: “by adjusting”

**Author response:** We have corrected the sentence to clarify the meaning (P9, L2).

P9, L11-22: add description about what was used as the background spectrum, and the approach used for scaling and baseline adjustments, etc.

**Author response:** We have edited the paragraph to better explain the FTIR methods. The use of KBr as background and baseline adjustment method used is now included (P9 L22-P10, L2).

P13, L12 (5): reference error. Also, consider replacing “combustion” with “contrasting levels of thermal treatments”

**Author response:** The sentence with missing reference has been removed. We have also changed the wording as suggested.

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

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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.

**Author response:** We have now decided to include the full report of statistical tests as an appendix to the manuscript. The statistical tests we performed were described in Section 2.4. In the manuscript we have used the term statistically significant to mean where p-values from Tukey's HSD test are  $< 0.05$ . We have also indicated the p-values to the correlation coefficients in Table 3.

P14, L5 (P13, L22): Here the authors state "significant effects" but have not provided sufficient detail about the results of their full set of analyses.

**Author response:** We address this comment by including of the results of ANOVA tests in the appendix. We think this might be too much information to publish as supplementary materials, but we will let the editors make that decision.

P15, L23-P16, L1 (L13-16): 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.

**Author response:** The sentence is talking about the combustion of specific types of organic compounds. We have re-written the sentence to make the meaning clearer (P15, L19-22).

P16, L14: Revise: awkward sentence L17: observed L24: revise punctuation to: "...heating intensity; that is, lower..."

**Author response:** We have made language corrections to the suggested parts.

L23-P16, L3 (P16, L10-17): 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

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to clarify your meaning.

**Author response:** We have re-written the entire paragraph to clarify the meaning. Specifically, what was meant by ‘slowness’ of the process is the charring of OM which happens more at lower temperature heating in our experimental setting as opposed to total combustion (P16, L14-P17, L5).

P18, L15 (L3): replace “most significant” with “greatest” (especially because all the statistical results have not been reported in this version).

**Author response:** We have re-worded the statement as suggested here. Also, in response to this and previous comments on reporting of statistical test results we have included results of the statistical tests as an appendix.

P18, L18: revise to clarify your meaning, or omit “below”.

**Author response:** We removed “below” as suggested. (P18, L14)

L23: omit the parenthetical clause because it is redundant with the information that follows.

**Author response:** We have removed the parenthetical clause as suggested. (P18, L18)

P19, L20 (L7): I don’t think that 2

**Author response:** The sentence has been re-written as suggested. (P19, L9)

P20, L13: replace “got” with “was” or “became”

**Author response:** We have replaced the word as suggested (P20, L2).

Figure1: Assign letters to figure panels. Revise caption to state which panel shows the basemap of tree canopy cover.

**Author response:** We have edited the figure and caption as suggested.

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Figure 2: Very nice figure that shows clear trends across the temperature treatments.

**Author response:** Thank you for comment.

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.

**Author response:** We have formatted the figure to be similar to figure 2. Text size has been increased, all the panels now have a common x-axis label, and the legend has been positioned to top of figure to increase space for individual panels.

Figure 5: Provide more detail in figure caption, for example, state that heating temperature is shown to the right of each spectrum

**Author response:** We have added information to the caption as suggested.

Figure 6: Increase the font size used for axis labels and axis titles. Statistical results?

**Author response:** We have increased font size as suggested. We have not indicated statistical significance in the plot because such information for the different soils would overcrowd the plots to the point where it would be difficult to interpret.

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

**Author response:** We have expanded the table caption to indicate that p-value for the correlation coefficients was  $<0.01$  and have explicitly indicated where p-value was  $>0.01$ .

*We appreciate the thoughtful comments from the reviewer. Thank you.*

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Interactive comment on SOIL Discuss., doi:10.5194/soil-2016-57, 2016.

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