

Public justification (visible to the public if the article is accepted and published):

Thanks to the authors for their comprehensive responses to the reviewer comments. It is my view that the manuscript is very close to being accepted, but I would like to see a few extra components address and then will be happy to move to publication.

Thank you for the favorable impression of our revisions. We have provided responses to each request of the editor below in blue text.

I see the removal of temperature ranges from the figures relates to responses to reviewer 2. However, I believe the temperature ranges are an important component of the study and I believe the figures benefit from their inclusions – readers want to see the range of these temperatures. My recommendations would be to simply add a better description of why the temperatures overlap (the temperatures are not the treatments, rather the ecosystem types) in the methods. I still believe this is underdone in the methods. While Table 1 provides some of this temperature data, the confusing part that remains is that there is no distinction in temperature between moderate and high temperature burns in Douglas Fir forests. Please better explain how categories of “low”, “moderate” and “high” temperature treatments (for lack of a better term) were defined, particularly for Douglas Fir forests, but indeed all the ecosystem types.

We do not use temperature treatments in this study, but rather characterize alterations to the organic matter in terms of burn intensity and resultant burn severity. Burn severity is defined as the effect of fire on the environment, through changes in vegetation and soil after a fire. It is not a measure of fire intensity (the amount of energy released from the fire), nor burn temperature, though it is related to both. For example, you could have a very hot fire that burns through an ecosystem rapidly but produces a low burn severity because it did not actually have time to transform or consume much of the above or belowground biomass during the burn.

We used a field guide for assessing post fire soil burn severities to assess the burn severities of our experimental burns. These are done visually, through assessment of the degree of alteration to the materials burned, after the fire is extinguished. Burn severity was assigned to each solid char samples using visual post-fire field metrics from the descriptions outlined in USFS Patterson et al. 2010 field guide. Burn severity was visually determined based on ash color, degree of consumption, and degree of char on vegetation. Burn severity categories assigned were low, moderate, or high. Control vegetation that was not combusted or burned were

classified as unburned. Assigned severities were recorded for each char sample and photographs exist in our data package, and examples of each are in SI figure 1.

Given these details above, we do not want to propagate any conflation of burn temperature with burn severity. We believe that adding the max temperature ranges back into the figures will decrease clarity on our methodology, possibly enabling incorrect interpretation of our figures. Therefore, we have elected to keep the maximum temperatures off the figures and have clarified the text surrounding these points throughout the manuscript in line with the descriptions above (Lines 118-119, 123-124, 164, 168, 172 in the track changes version of the manuscript).

Lines 60-61: The addition here does not add much value and I would make the argument that it actually detracts from the flow of the study because it is difficult to understand what this information from Ball et al. (2021) actually means based off the sentence as it is written. Please either remove the statement or clarify more clearly what is mean by "impacted 11% of total western US river length in recent years". This statement is not intuitive and contains ambiguities (i.e., "recent years").

This has been deleted as suggested.

Lines 308-310: ">774degC or greater", please remove the redundancy "or greater". As suggested by reviewer 1, please add a comment that these data likely underestimate P releases from higher intensity burns (relating to the volatilization temp of P).

">" has been deleted per suggestion. We added the following sentence immediately after this on lines 302-304 in the tracked changes version of the manuscript: *"Therefore, our study may underestimate P transformations linked to P volatilization from burns that reach higher temperatures than our experimental burns."*

Lines 368: Issues with the axis label overlapping the axis.

We believe that this issue was only in the track changes version of the figure on line 368, as we do not see this issue in the final pdf version or the individually uploaded figure. Please let us know if you are still seeing this issue in the current version of the manuscript and figures.