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Interactive comment on "Fire-regime variability impacts forest carbon dynamics for centuries to millennia" *by* Tara W. Hudiburg et al.

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Comment 1 (SC1) We thank the reviewer for thoughtful and helpful comments and have addressed many of the suggestions (see specific replies below). - Page 2, line 48: we suggest changing the word "great" to "greater" since it is followed by the word "than" and in comparison, certain adjectives such as great should get an "er" or "est" at the end.

Response: This was a typo. The text now reads: "...was of a greater magnitude than simulated...".

- Page 4, line 83: we would change "significance influence of fire" to significant influence since it makes more sense

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Response: We have chosen to keep “of fire” as it more explicitly defines what we are referring to (rather than climate).

For a better understanding and conception, we suggest the following: - Page 2, line 40: we would find a definition of “C trajectories” helpful

Response: We have added the following clarification: “(i.e. future states or directions)”

- Page 3, line 61: it is somewhat unclear what the authors mean by pool sizes, we suggest that they indicate which elements pool sizes they specifically mean (e.g. carbon or nitrogen or etc.,)

Response: Done.

- Page 3, line 71: it is not clear what is meant by Net Ecosystem Carbon Balance (NECB)

Response: Yes, this was unclear until the methods. Thank you for pointing this out. We have now added text describing NECB (the balance between net forest carbon uptake and forest losses through fire emissions).

- Page 4, line 86: the term “spin up” is confusing. We suggest that the authors try to explain and clarify this term in a more understandable wording perhaps by defining this term with a simple example before using it.

Response: We added the following sentence for clarification: "To initiate the model, C and N pools need to develop, as they start from ‘bare soil’ with no vegetation; as vegetation grows the modeled soil pools increase, and it takes hundreds to thousands of simulation years during this "spin-up" period for the C and N pools to equilibrate.

- Page 5, line 139-141: “Day Cent” Is well described but already mentioned in section 2.1, therefore we suggest the description should come earlier

Response: We switched the order of the sections so that the Model Description is now Methods section 2.1 and the study site is section 2.2.

- Page 6, line 151-152: is L:N and lignin to nitrogen the same? It is not mentioned in the text

Response: Yes, we changed the L:N to lignin to nitrogen for consistency.

- Page 7, line 182: from our point of view, the “key difference” between the two fire types should come at the beginning of the paragraph

Response: We moved “The key difference between the two fire types simulated is the associated soil erosion” to the beginning (second sentence; line 181 now) of the paragraph.

- Page 8, line 208: timeframe CE, is that defined as common era?

Response: Yes, we added “common era” in parentheses.

- Page 8, lines 211-219: we think the explanation of different scenarios can be expressed in a more precise and separated way. The description of additional scenarios make it difficult to understand and follow the subject since they’re told altogether. Perhaps by separating the scenarios and explaining each of them on an independent paragraph, the concept can be easier to follow. The use of that many brackets makes it more confusing than helping anything.

Response: We agree the descriptions were confusing. The text has been separated in to distinct paragraphs with more explanation of each scenario.

- Page 9, line 248: isn’t the data fitted? Not surprising that it is “broadly in agreement”

Response: Fire occurrence is “fitted”, but not C losses. We include the comparison to indicate that DayCent is capable (some models are not) of replicating the expected C emissions from fire in this region.

- Page 13, line 360-365: very long and complicated sentence. We would suggest making more than one sentence out of it for a better understanding

Response: This text has been changed (and edited).

- Page 13, line 369: the word “woody pool” should be clarified

Response: Done.

- Page 14, line 383 & 388: are “ecosystem states” and “biogeochemical states” the same? Here we would need simplification or a better definition

Response: We are using them interchangeably, but decided to just use biogeochemical states.

Concerning the figures: - Implement results in Table 1

Response: We think providing the results in Table 1 would be repetitive, and thus unnecessary.

- Figure 1: For a better visual understanding, it would be nice to have at least two different colors for the different types of fire. Also, different symbols could be used. The spacing between the line is very big and could be better used. It would be sufficient to have only one legend as it is the same, and we can read the word “high severity fire” four times in a small figure. That could be simplified.

Response: We changed the fire severities to two different symbols (open vs closed) and now use only one legend as well as making the symbols larger.

- Figure 2: It is too confusing that the grey Equilibrium line and the yellow Equilibrium + 2 degrees have the same value on the y-axis but it’s not shown.

Response: We have removed the warming scenario for the figure for clarity and simply explain the impact of the results in the discussion.

- Figure 1, 2 and 4: In the text the time data is in CE. In the Figures time data Cal BP is used. We would suggest to only use one time specification.

Response: Generally, tree-ring records that extend back several centuries (e.g., the

tree-ring inferred fire date at Chickaree Lake), are reported in years CE, while lake-sediment records, which extend back thousands of years, are reported in years BP (to avoid negative values, prior to 0 CE). We understand how this can be confusing, so we added years BP to the few places in the text where we refer to year CE.

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