

## ***Interactive comment on* “Technical Note: Linking climate change and downed woody debris decomposition across forests of the eastern United States” by M. B. Russell et al.**

**M. B. Russell et al.**

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### General comments

This short ms describes a simulation experiment using U.S. Forest Inventory and Analysis data, to examine how residence time of downed woody debris (DWD) might change in the future under various climate and forest type scenarios. This is a very limited analysis, but potentially useful, given the importance of DWD for wildlife, management, carbon cycling, etc. The ms is well written and topic appropriate for Biogeosciences.

\*\*We thank the reviewer for their comments and insight. We agree that this work has

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broad applicability in wildlife habitat management, carbon cycling, and fire ecology.\*\*

I have three general concerns. First, the authors' methods and conclusions seem to be seriously called into question by the just-published Bradford et al., "Climate fails to predict wood decomposition at regional scales" in Nature Climate Change (see DOI below). I'm sure the authors will want to cite/discuss/compare with this publication, which finds that only with aggregated data (as here) does climate control DWD decomposition. This seems to have obvious implications for Russell et al.'s assumption that temperature is the primary mechanism controlling future DWD decomposition.

\*\*We cite and include discussion of the Bradford et al. study in our subsequent revision (Introduction, Results, and Discussion sections). Local-scale factors (e.g., termite biomass and fungal colonization) no doubt play an extremely important role in determining wood decomposition rates. However, in the absence of such information collected at broad regional scales (such as the US Forest Service's Forest Inventory and Analysis database), the use of climate information to inform decomposition patterns is the focus of this technical note. As our emphasis is related to climate, we are unaware of any approaches that consider future global change scenarios and their impacts on the distribution and abundance of such local scale factors. Incorporating coarse estimates of local scale factors and their associated dynamics would no doubt increase the uncertainty of our estimates in changes in residence time compared to changes based solely on climate regime.\*\*

Second, a number of the methodological details need to be clarified. See below.

\*\*We clarify these details raised by the reviewer, as noted below.\*\*

Third, I'm not sure this is novel, significant, or sophisticated enough for publication in Biogeosciences. To say that residence time of DWD will probably decrease in a warmer climate: : probably true, but I don't know if this fairly simplistic analysis really makes that case.

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**\*\*We agree that the residence time of DWD will decrease in a warming climate is a scientifically plausible statement. The value in this analysis is quantifying the rates of decrease in the residence time of DWD and the implications for ecosystem dynamics, which to our knowledge has not been reported in the literature in this region or in others across the world. For example, Table 3 and Figure 2 quantify projected decreases in DWD longevity in terms of years, which can be included in various ecosystem simulation models. Figure 3 assesses the impact of these decreases in dead wood longevity in terms of C flux, allowing a broader assessment of the influence of global changes scenarios on the temporal dynamics of the deadwood C pool.\*\***

===== Specific comments

1. Page 9014, lines 1-4: poor grammar, reword

**\*\*We reworded the sentence in the abstract: “Forest carbon (C) is stored through photosynthesis and released via decomposition and combustion.”\*\***

2. P. 9015, l. 19-20: by definition, no?

**\*\*We reworded the sentence in the Introduction: “Increased rates of decomposition will likely reduce the duration that woody debris is available for dead wood-dependent organisms.”\*\***

3. P. 9015, l. 29: why is transient responses quoted?

**\*\*We removed the quotations.\*\***

4. Equation 1: Vol is initial volume?

**\*\*Correct. We confirm this is initial volume in the fourth paragraph of the ‘Analyses’ section.\*\***

5. P. 9018, l. 17: what is a cumulative link mixed model?

**\*\*We provide a brief description of the model with a citation: “Cumulative link models**

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(CLMs) are a type of ordinal regression model in which response variables are considered categorical or ordered (Agresti 2007).<sup>\*\*\*</sup>

6. P. 9020, l. 19-21: what about Bradford et al. just published, 10.1038/CLIMATE2251?

<sup>\*\*</sup>We reworded this statement: “Hence, in the absence of local-scale factors to use as a surrogate for decomposition (e.g., Bradford et al., 2014), employing temperature differences under future climate scenarios may be used to at least in part to explain DWD flux across the eastern US.”<sup>\*\*</sup>

7. Figure 2: maybe not the best way to display these data; most of the plots are empty space

<sup>\*\*</sup>We have instead presented this figure in a table to show the values of the changes in residence times of these data. This now appears as Table 3, and reference to subsequent tables and figures have been adjusted accordingly.<sup>\*\*</sup>

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