

Review of revision 1: “Combining empirical and mechanistic understanding of spruce bark beetle outbreak dynamics in the LPJ-GUESS (v4.1, r13130) vegetation model” (gmd-2024-239)

I was reviewer 2 on the initial manuscript; the authors have done a good job responding to my initial comments. I have some more, but I recommend this be published subject to what I think are minor revisions. The only reason I think I would need to review again would be if there still seems to be confusion about my comment 13 on my original review (which I’ll refer to as my comment 1.13; see comment 2.6 below).

All line numbers refer to the “authors’ tracked changes” version of the manuscript.

Comments on replies to my initial review (mostly):

- 2.1) Re: my comment 1.6: I think I’m satisfied with disturbance being turned off in this experiment, given the likely low rate in this region.
- 2.2) L194-201: “The fraction of the different age and management classes, from the landcover functionality in LPJ-GUESS, were used to calculate Pgridcell weighted over the classes. With all variables in the (Marini et al., 2017) model at ± 2 standard deviation from the mean, R has a range of $-4.66 - 3.36$, but interactions between variables prevent it to reach higher numbers. R calculated from the observation data used in the present study (see 2.4 below) has a range of $-2.2 - 2.9$, but initial high numbers in the start of an outbreak were often missing as inventories only began when already under an outbreak situation. The total range of R (Fig. 1a) in the presented model was set to $-3.8 - 6.0$, where the possible outcome range of the different parts of the model (Eq. 4, Fig. 1a) were given weights of the similar magnitude as in the (Marini et al., 2017) model.”
 - Refer to Sect. 2.6 where you calculate the -3.8 number.
 - What are the “weights” here that you are “giv[ing]” the model components? I don’t see any weights in Eq. 4, and the only weights previously mentioned have to do with the different age/management classes.
 - Is the “The total range of R” another setting you applied, or is it just the emergent result of the “weights” you gave?
- 2.3) Fig. 1a: Are the light parts the *only* ranges you used for optimization, or did you also include the dark part? And what is the dark part—the final allowed range?
- 2.4) Fig. 1b: Was k_2 min intentionally changed from pink to orange? If so, why?
- 2.5) Before showing Equations 7 and 8, remind the reader in words what those terms are supposed to represent (respectively: effect of landscape-scale and substrate-scale competition [or the relief thereof, at low densities]).

- 2.6) Re: my comment 1.13: I don't think I was clear. Looking at Eq. 9, and the text directly after (as the authors mentioned in their reply), I'm only seeing change in L due to tree mortality: " L_{mort} is C mass of stem mortality of spruce trees above a diameter threshold (d_{lim}) for previous year caused by other reasons than bark beetles (including storm)." That's not an "absolute amount" as the authors said in their reply; the way I read that sentence, L_{mort} is *one influx* to L . That's because mortality is a flux variable, not a state variable. Why would L only include one year's influx rather than the total amount of stem litter? Do beetles not eat wood that's been dead for more than a year?
- 2.7) Re: my comment 1.24: The authors reply that they "think that most readers are familiar with the gallery term," but least 50% of the readers so far (i.e., me) weren't. I'm a vegetation modeler with no entomological background, which I suspect describes many of this article's potential readers. It should be defined.
- 2.8) Re: my comment 1.27: I guess what I was saying is that I don't understand how this bit relates to the rest of the paragraph. It would be good for the authors to draw that connection.
- 2.9) Re: my comment 1.28: Still, "but" seems wrong. The part of the sentence after the comma seems to be *supporting* the part of the sentence before, rather than contradicting it.

Other comments

- 2.10) L75: "but has **only** been evaluated"
- 2.11) L87: "are" should be "is".
- 2.12) L157: "BLAZE" should be "SIMFIRE-BLAZE": BLAZE is just the fire impacts module, with SIMFIRE giving burned area. There should be a citation here of the first LPJ-GUESS SIMFIRE paper: Knorr et al. (2016, *Nat. Clim. Chg.*, doi: 10.1038/nclimate2999). BLAZE unfortunately hasn't been published; the most complete description is as part of Rabin et al. (2017, *GMD*, doi: 10.5194/gmd-10-1175-2017).
- 2.13) L186: "R for M (Eq. 5)" should be "M on R (Eq. 6)".
- 2.14) L362: "where" should be "were".
- 2.15) L483: "spruce'" should be "spruce's".
- 2.16) L490: Delete "of a".
- 2.17) L567-569: This new sentence is too vague, or maybe it's hard to understand why it's included. It needs to be tied in more clearly with the story being told in this paragraph.
- 2.18) L575: "has" should be "have".