

Re-review: Simulating Bark Beetle Outbreak Dynamics and their Influence on Carbon Balance Estimates with ORCHIDEE r7791

The authors have done a great job of responding to my comments on their original manuscript. The new version is much easier to follow and more complete. I also appreciate the work they did to add context from relevant literature, as requested by the other reviewer. I still have a number of substantive comments on this version, but none of them are really major issues.

Substantive comments

- Figs. 1 and 2 are very low-resolution and text is hard to read. Fig. 3 also has weird text but it's larger so not as much of a problem.
- Line 265: How is this limited to between 0.5 and 1? Looking at the subsequent equations I don't understand.
- Line 281 (Eq. 5a): The "1 -" in the exponential seems to make this function point the incorrect way, with $i_{hosts\ defense}$ lower (i.e., stand is less attractive to beetles) when PWS_{max} is high (i.e., strong drought happened recently) and vice versa.
- Line 285 (Eq. 5b):
 - What is "nb age class"?
 - Why is age class 1 the maximum considered?
 - (The above two questions also apply to Eq. 6b.)
 - Are the PWS values here averages? Over what time periods?
 - If PWS_{spruce} is this year's plant water stress, $PWS_{spruce,n-1}$ is last year's, etc., then $PWS_{spruce,n-3}$ being included means that it's actually looking over the past *four* years, not three as mentioned at line 279.
- Lines 358-361: This text suggests that Fig. 1 shows both a return to endemic stage and an evolution to epidemic, but it looks like it only shows the latter.
- Line 393: Is $B_{wood\ live}$ biomass only?
- Lines 451-452: Why is this index calculated separately for each age class whereas the indices contributed to by Eqs. 5b and 6b are calculated as cross-age-class averages?
- Lines 490-491: What does "acclimation" refer to in this sentence?
- Line 517 and in Results: Ranges don't make sense in this context. What exact values were tested? Line 516 says that only three values were chosen.
- Lines 559-560: Is this 20% number referring to max_{Nwood} ?
- Lines 566-571: How do you calculate number of generations per year?
- Lines 573-581 and subsequently: "Control" and "climate experiment" feels weird. For the sites, it's more of a climate gradient that starts with HYY and continues through HES/FON. There's nothing *a priori* different about HYY that makes it a "control" and the other sites "experimental." Similarly for the windthrow damage rates: Maybe if the lowest value was 0 that would be a control, but it's not. (Note that I'm not saying true control treatments are needed—I don't!)
- Lines 588-593: Note that (1) is the default or previous ORCHIDEE setup.

- Sect. 4.1: I'm unclear on how the sensitivity tests indicate anything about "false positives" due to the calculation of any specific parameter. Weren't all experiments done with all parameters?
- Table 4: Missing $S_{competition}$.
- Lines 683-684: This sentence is confusing. "Turning back" from what? If the "tipping point" is 9 kgC/m², what is the "threshold"?
- Lines 684-685: REN clearly reaches *some* "tipping point"—i.e., it reaches a minimum and then recovers. What's so special about 9 kg/m²?
- Fig. 7: Add shading or some other indicator of where the outbreak (as defined according to Table 3) begins and ends.
- Lines 721-722: "a more resilient recovery" doesn't seem right for the continuous case, where there's no specific event to "recover" from.
- Lines 752-753: Unclear how this sentence is related to the rest of the paragraph (snags).
- Line 767-775: Terms should be defined in this paper. It's not really helpful to cite a paper for readers to look up the definitions, especially after the terms are used. Ideally definitions should be mentioned in the introduction or methods so that they're defined before they're used—note that "resilience" is used in the results section.
- Lines 777-799 (Sect. 5.3): Discussion (and also Conclusion) should mention that this depends on spatial scale and model use. If one is looking at global-scale NBP, there might not be as much of an impact of including abrupt disturbances because they're happening constantly somewhere.

Technical corrections, etc.

- Line 257: "analogue the the" should be "analogous to the".
- Line 279: "average" is sort of confusing here. It looks like it's the (weighted) *average* across different age classes of the *maximum* water stress in each age class. Maybe just delete "the average" from this sentence to make it work.
- Line 288: A paragraph break before "In addition to drought" would help break this section up a bit.
- Line 308: "mean quadratic" should be "quadratic mean".
- Line 323 (Eq. 7b): "none" should be "non"
- Line 372: Is "excess" the right word?
- Line 409: Incomplete sentence: "The amount of suitable tree hosts."
- Line 464: "bettles" typo in subscript.
- Line 501 (Table 2):
 - I thought the spelling looked weird for "Wetstein," and indeed, it doesn't actually seem to be a place in Germany. The listed coordinates point to Třeboň, Czechia, about 400 km southeast of the similarly-named German mountain Wetzstein. The listed coordinates do, however, look similar to those of the [CZ-Wet \(CZECHWET\) site](#) near Třeboň.

- I can't find the HES site in the [FLUXNET site table](#), or any site with similar coordinates. It's possible it's just missing from that table, but given the above issue it warrants a double-check.
- The FON latitude appears incorrect according to the FLUXNET site table.
- REN site latitude should round up to 46.6°N. (Check rounding of other sites as well.)
- Line 570: Reference to Fig. 3 should be to Fig. 4.
- Figs. 3 and 4: These figures refer to "Control" and "Climate experiment" which isn't explained until later in the text.
- Line 606: Delete ")".
- Line 607: Delete ")".
- Line 617 and elsewhere: Instead of having to say "4th row, 2nd column," add subplot labels a-h.
- Lines 678, 683: Thousands separator should be comma, not period. So 9,000 instead of 9.000. Or to avoid cross-cultural confusion, just use 9 kg instead of 9,000 g.
- Line 718: "Abrupts" typo.
- Line 731: "maining"?
- Line 761: First comma should be a semicolon.
- Line 767:
 - "resistance" should be defined. It's not really helpful to cite a paper for readers to look up the definitions, especially after the term is used.
 - "locations" should be "location" (or just deleted)
- Line 810: "Ips Typographus" should be "*Ips typographus*"
- Lines 811-812: Latin name should be italicized
- Line 860: Same DOI repeated twice. Maybe these both will be replaced with the new DOI the authors mentioned in their cover letter?