

Hydrol. Earth Syst. Sci. Discuss., referee comment RC1
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Comment on hess-2020-679

Anonymous Referee #1

Referee comment on "How does water yield respond to mountain pine beetle infestation in a semiarid forest?" by Jianning Ren et al., Hydrol. Earth Syst. Sci. Discuss.,
<https://doi.org/10.5194/hess-2020-679-RC1>, 2021

I cannot find any reason not to publish this paper. Below I list five points that I think might improve the paper. I recommend publication after some revising.

Suggested Improvements

(1) At the top of page 3 the authors provide a graphical abstract, which is quite helpful to the paper. But I wonder if it is possible to do something similar regarding the physical processes or (water) pathways that are emphasized or de-emphasized or changed from one (temporal + spatial + disturbance) regime to another? I hope this suggestion is clear. As I understand this paper, the authors are describing a systems approach (or model) addressing tree mortality in the Western US. But it seems to me that the paper is largely descriptive of some of the environmental conditions and how they lead to different outcomes for a forest. I think it would be more insightful to discuss the ways in which pathways, by which water moves through the forest ecosystem, change in response to changes in the drivers.

(2) As a follow on from (1) above, I think it would be helpful to move the last paragraph (lines 616-629, page 29) to the introduction. It would help to put the modeling effort into

context. Otherwise I was left to wonder until the last paragraph what the application of the authors' modeling effort might be and who might benefit from reading this paper.

(3) I have no doubt of the importance of aridity in their findings. Current expectations are that aridity in the western US will continue to worsen as climate change progresses. Nonetheless, I am having some difficulty with the term "long-term" aridity. Yes, they do have a 38-year record. But at present aridity is dynamic (and has the potential to get much worse in far less than 38 years). I think the authors need to recognize and mention in their work that the past record may not be as useful in trying to project into the future as their findings suggest. Simply extrapolating from the past 38 years of data may bias their results somewhat, especially if aridity (as represented by the aridity index) is prone to rapid intensification. The paper would benefit by including further discussion of this issue.

(4) In the Introduction the discussion of sublimation should probably cite Frank et al (2019: *Bayesian analyses of seventeen winters of water vapor fluxes show bark beetles reduce sublimation*. Water Resources Research 55: doi:10.1029/2018WR023054). The findings of Frank et al. (2019) are germane and relevant to the authors' paper. Furthermore, Frank et al. cite other works that the authors should probably cite when discussing the impact that beetles can have on the (canopy-atmosphere-environmental) processes involved in sublimation. Given the importance of snowpacks and sublimation to forest ecosystem water balances I would suggest that the authors provide further discussion of the details of the model's performance regarding sublimation. The model's predictions regarding the change in sublimation (from the snowpack and from the foliage-intercepted snow) before and after the beetles have killed the trees would provide some further insights into how well the model captures these important sublimation-related processes and observations. And although different observers/papers report somewhat different findings, I think comparing the model's predictions of changes in sublimation amounts and stream flow to previous observations would be worthwhile, especially for a systems level model like the one the authors are using.

(5) Lines 344-354, Pages 16-17 – These equations do not make dimensional sense to me. Either Q , P , E and $Sublim$ are rate variables (i.e., mass/unit time) or the storage terms, ΔS , should not be divide by dt . If they are rate variables, the authors should include the physical units in their definition. If they are total amounts (i.e., mass) then they should say that and correct the storage terms.