Author's response

We thank the time and effort of the reviewer. These positive feedbacks and discussion are very helpful and much appreciated. Below are the responses in detail (red font) and text that we will change in the manuscript is in blue text.

Comments

The authors contributed a very interesting manuscript that is within the scope of the journal and the scientific quality of the ms is very good. Much of my research is in ecohydrology and one recent ms showed the effect of beetle defoliation in dryland riparian corridors of the SW USA and how water use (ET) on these corridors (13 rivers and streams) changed before and after the introduction of the beetles (see Restoration Ecology 2018); therefore, the authors contribution is of great interest to me and certainly contributes something new to the field of hydrology. There are citations that could be added to the ms. background to further demonstrate changes in riparian corridor ET before and after beetle introductions, although their paper is unique in looking at mountain pine beetle infestation and adding in other types of woodlands may not be needed. I have really learned from their discussion and the long-term aridity index is an excellent contribution to water yield research. These results (key points) show that separating wet years and dry years may provide important knowledge that is useful in other systems. I am curious now to apply similar methods in riparian corridors to see if in fact the response to mortality level remains nonlinear and varies by location and year, as I suspect it would in other beetle-infested land covers. My findings suggest that in canopies that were monotypic with high density and extent had increased water yield could be wiped out entirely but then regrown. The regreening post mountain pine beetle does not exist I presume and therefore this work may not be transferrable to other ecosystems, but I do believe this ms and its findings, especially the drought information, is of great interest to the readership. This conclusion was therefore of most interest: " in a dry year, low to medium MPB-caused vegetation mortality decreases water yield, and high mortality increases water yield; this response to mortality level is nonlinear and varies by location and year."

Thanks for these valuable suggestions and thoughts. We will add more description in the background section starting at line 145 (page 8).

In some riparian corridors, the regreening of surviving vegetation and the compensatory response of remaining tissues could diminish the reduction in ET caused by foliage fall, leading to no significant water yield response to beetle-caused mortality (Snyder et al. 2012; Nagler et al. 2018).

Further discussion on testing our method to riparian corridors:

Riparian corridors may also influence the extent to which mortality and climate variability affect hydrology. We expect that whether ET increases or decreases depends on the competition between higher transpiration rates of surviving vegetation (plus the ground evaporation increase due to open canopy) and lower canopy evaporation and transpiration caused by less canopy foliage. With lower mortality level, the reduction of transpiration (caused by less LAI) can be small (especially during dry years), and the increase in transpiration rate of surviving plants could be higher, so it may cause an increase in ET or less significant changes in ET. While at high mortality, the reduction in ET caused by less LAI is dominate. Our model results also show an increase in transpiration during dry years caused by higher transpiration in surviving vegetation. This is consistent with a thinning study in a semi-arid forest, where growth rates are 70% higher and transpiration rate are 10% higher after thinning (Tsamir et al. 2019). However, our study site is a snow-dominated watershed and canopy snow sublimation plays an important role in the hydrological response to mortality, indicating that our findings may not be transferable to the riparian corridor sites. However, with the correct vegetation regrowth parameterization, our model can capture the beetle-vegetaton-water feedbacks and could be tested in the proposed sites. By combing with fieldwork data, our model framework can help understand the dynamic changes of vegetation and hydrology after disturbances to better evaluate the water-saving efficiency of biocontrol programs.

References

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