

Interactive comment on “Reviews and syntheses: On the roles trees play in building and plumbing the Critical Zone” by Susan L. Brantley et al.

Anonymous Referee #2

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Review of bg-2017-61

Overview: I read with great interest this review manuscript on the role of tree roots in the Critical Zone (CZ). I applaud the authors for taking on this enormous task of bringing together a diverse set of disciplines involved. The result is a tour de force. The manuscript sets up the role of tree roots and associated mycorrhizal fungi within two broad categories of 1) building and 2) plumbing the CZ. My overall assessment is this is a good start on development of a review and synthesis manuscript here. But in its current form the emphasis is big R (review) and little s (synthesis), and the manuscript would be stronger if there was also big S. There is quite a bit of variance in the depth of insights provided among the hypotheses. None of them give clear paths forward for developing the science. I think the authors should make bold statements here. After all, the aim of review/synthesis manuscripts is to identify new knowledge where it is not

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obvious from the individual parts.

Specific comments: I read this three times, and each time I tried to think about the distinction between the two broad categories. It remains unclear how building the CZ is distinct from plumbing it. The hypotheses do not help clarify these categories either, and in some cases they add confusion. Some of them seem immediately testable, at least with the effort to get the samples in space or time (e.g., H1, H5), while others are general, somewhat vague propositions (e.g., H2, H6). One suggestion is to turn these into questions, which would lend a more uniform treatment to the sub-categories. A second issue with some of the hypothesis sections is that they read a little like watching a tennis match. For example, in one section roots use shallow water, except when they do not. In another, roots use water that is isotopically similar to rainwater, except when they do not. These are clearly opportunities for identifying research questions that could make a huge difference, but they are not used that way within the hypothesis sections, and so there are many missed opportunities. A third issue with the hypotheses is that there is little synthesis across them. There are a few hooks here and there, but less effort to weave them together so that readers can see the new knowledge to be gained. Fourth, the hypothesis sections never highlight the challenges or issues to be resolved, or tell the reader how to advance science. What are some next steps? Some attempt at synthesis and advancement is started in the conclusions section, but I think this has to be done within each hypothesis section and then tied together in the conclusions.

Specific comments: Title: The title is too broad. The manuscript is focused on the role of tree roots and mycorrhizal fungi on CZ processes. With the exception of a brief mention of the differences in root traits among AM and EM species the manuscript does not make much of tree traits in general, and so I think the title is currently a bit misleading.

Figures: Some of the figures are either no necessary or are a bit misleading. Figure 2 is important, but some of the details are not provided in the caption. In particular, terms

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such as h and H are not defined here, and graphics C and D are not described. Figure could be deleted without harming the paper. It is barely mentioned in the text and its portrayal of trees with roots accessing gravity-drained water or not oversimplifies the problem.

References: There are a number of errors in the references, including duplicates (e.g., Bornyasz et al 2005a,b), incorrect issue number (e.g., Chen et al., 2013 PNAS), and wrong journal (e.g., Jackson et al., 1999 should be PNAS, not Ecology).

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