

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

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General Comments:

This manuscript provides an engaging review of the science regarding the role of tree roots, and associated mycorrhizal fungi, in moderating processes within the critical zone. The topic is timely and relevant to a broad readership, especially (as noted by a previous reviewer) if the synthesis components can be further emphasized to meet the high level of the review components and together work to help steer directions forward within the research community. The paper is well written, and previous reviewers have provided detailed comment on the text and figures that address many of my concerns. However, I believe the figures are in need of additional improvements beyond what has already been highlighted by the other reviewers. Several unaddressed concerns still

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remain and have inspired myself, and my affiliated research group, to provide comment to help in improving this important piece. These comments are both my own, and, in part, are on behalf of the Southern Sierra CZO, and were gleaned through a lively discussion about this paper orchestrated during a recent research group meeting.

Specific Comments:

1) Figure 2: In the Southern Sierra CZO and Reynolds Creek CZO, as well as other locations, it is observed that roots are commonly emplaced within the weathered immobile material, growing and accessing the water there (Arkley, 1981; Graham et al., 2010; Niemeyer et al., 2017). Tree roots however are not drawn within the "weathered immobile material" in Fig. 2B (they are only drawn down to its top surface). Additionally, is there a reason why the mobile soil is deeper in Fig. 2B than Fig. 2A? I agree "H" can be significantly deeper in some locations/regions more than others, but for a similar slope with similar vegetation sizes I would expect "h" to be similar, despite large differences in "H". Regarding figure details, previous reviewers point out some grammatical issues, but additionally in Fig. 2D is the "hydrologic pump" arrow intended to point the other way?. Also, the "weathered immobile material" in Fig. 2D is missing its cross-hatching in comparison to Fig. 2B.

Arkley. (1981). Soil Moisture Use by Mixed Conifer Forest in a Summer-Dry Climate. SOIL SCIENCE SOCIETY OF AMERICA JOURNAL.

Graham, R. C., Rossi, A. M., & Hubbert, K. R. (2010). Rock to regolith conversion: Producing hospitable substrates for terrestrial ecosystems. GSA Today, 20(2), 4–9. Journal Article.

Niemeyer, R. J., Heinse, R., Link, T. E., Seyfried, M. S., Klos, P. Z., Williams, C. J., & Nielson, T. (2017). Spatiotemporal soil and saprolite moisture dynamics across a semi-arid woody plant gradient. Journal of Hydrology, 544, 21–35. <http://doi.org/10.1016/j.jhydrol.2016.11.005>

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2) Figure 3: In the legend box, "Bedrock erosion rate" could be more accurately described as "Weathered immobile material erosion rate" or perhaps "Saprolite erosion rate" (if the authors are comfortable with that nomenclature). This detail is buried within the caption, but I feel this needs to be clearer in the figure itself, especially when in Fig. 2 the word "bedrock" is only used in context of fresh bedrock. I realize this figure is based on a previous figure, but these types of changes to the figure's text should be easy to make and can still pay reference to the original figure. Similarly, in the legend "thickness of bedrock" could be altered to "thickness of immobile weathered material" or "thickness of saprolite", and perhaps "depth of saprolite disrupted" for the Y axis. Using "Bedrock thickness" invokes the thought of fresh bedrock and is confusing to the reader. I agree with the hypothesis conceptually if these changes are made, but it needs to be clear that tree throw is only going to be removing material around its large roots, which likely do not extend all the way to fresh bedrock (as it looks like it is drawn in Fig. 2A), but instead are eroding weathered material at the mobile/immobile boundary only.

3) Table 1: For the readers unfamiliar with mycorrhizal fungi nomenclature, it may be useful to add a section on "Types of fungi", or something similar, to Table 1 to help in the readers in understanding potentially new terminology relevant to the manuscript (e.g AM/EM differences, etc.).

Technical Corrections:

1) Figure 1: I agree with a previous reviewer that this figure may need more explanation (and typos fixed) if it is kept in. If it is kept, I believe the pictures of roots need to have the roots highlighted in some way. As it is now, it is hard to discern the roots within the dark photographs. In general I don't believe this figure adds much to the discussion and perhaps could be left out without taking away from the main ideas of the piece.

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