

Interactive comment on “Quantification of dynamic soil – vegetation feedbacks following an isotopically labelled precipitation pulse” by Arndt Piayda et al.

Anonymous Referee #1

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Review Piayda and Dubbert et al., 2016 Quantification of dynamic soil – vegetation feedbacks following an isotopically labelled precipitation pulse, Biogeosciences Discuss., doi:10.5194/bg-2016-451

General Comments:

The manuscript presents a nice H₂¹⁸O-labelling study in a Mediterranean oak forest. Authors traced the fate of recent precipitation water in soil and understory vegetation and inferred from the respective partitions of this water for evaporation and transpiration on the use of recent precipitation for understory plants including the effects of tree shading on infiltration and water use. The study is generally well written and methods used seem generally sound. However, the discussion section at the moment is in parts

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confusing and gives room for improvement, as authors discuss many theories on e.g. hydraulic lift, competition for water between trees and understory, facilitation of infiltration through tree shade etc., but presently do not relate their results very well to these theories, which at the moment hampers the conclusion that they indeed disentangled all these processes. In addition, I believe that the study would benefit from a literature evaluation on the role of tree interception on infiltration and water use, a topic that has so far been disregarded in the study. The conclusions section and the abstract at the moment include deductions that either cannot be directly seen from the results, or are not well enough discussed yet. I am confident that after revision of these issues this topical field study will be acceptable for publication and appeal to the BGS readership.

Specific Comments:

Abstract The abstract is well written, but would benefit from a revision of the conclusions.

Page 1 Line 26: “unproductive water loss” odd wording

Page 1 Line 27: this sentence should be removed, as no information on biomass production, carbon sequestration or nitrogen fixation is given in this paper

Page 1 Line 28: “Light to medium precipitation events” Only one precipitation event was studied with 20 mm. I would not consider this light or medium, also this sentence sounds as if you would compare between precipitation events of different magnitudes, which was not the case in this study.

Page 1 Line 28: “This forces plants...” Too general: In this context this sounds, as if plants were generally forced to compete for water with trees in this system. You observed only a short period of the year, for which this is probably true. Reformulate to a more differentiated conclusion considering results of this study.

Page 1 Line 33ff: a bit too thick, see comments to conclusion section

Introduction Generally nicely written, the introduction would benefit from some hypothe-

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ses on tree and open side effects on water infiltration, E and T.

Page 2 Line 7: context: the use of “thus” is not indicated, I suggest removal of this term

Page 2 Line 17: context: the use of “for example” is not indicated, I suggest removal of this term

Page 2 Line 20: wording: consider rewording “stable water isotopes”

Page 2 Line 26ff: “most data sets were limited...” Some references for limited data sets would be adequate

Page 2 Line 33: “evaporative water use” Consider rewording, water that evaporates is not really used

Material and methods With small exceptions this part seems sound and methods and calculations are described adequately. However, a section on statistical analysis should be added, as the estimation of frequently mentioned significant effects in the results and discussion section cannot be inferred from the M&M part.

Page 3 Line 16: Please expand on possible effects of meshes used for bare soil plots on water infiltration

Page 3 Line 19: Irrigation was conducted how and over what time span?

Page 3 Line 28, 30 and Page 4 Line 3: replace “in a logger” by “by a logger”

Page 4 Line 6: fresh material was harvested, what was the proportion of already dry material, particularly in comparison to previous study of Dubbert et al. during a non-drought year, and the different effects of plant cover on infiltration reported in the discussion. This may have also reflected on the event water use in transpiration.

Page 4 Line 8 and 11: Presenting Fig. A1 is ok to characterize biomass and species composition differences of the sites. However, it could be redundant, as this information is only presented in the two lines here and 1 line in the discussion. Biomass and

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species composition effects on event water use are not discussed much later. However, the tree site being dominated by grasses and the open site being dominated by forbs and potential effects on water use may be worth discussing, which would give presentation of this figure some more impact.

Page 4 Line 17: Calculating g_t is presented as a method, but there is no data on this in the paper. I suggest removal.

Page 5 Line 5: Leaf sampling did not affect ET in the vegetation plots? How big was the reduction of leaf area through sampling? Could this have affected the temporal progress of T from event water? Please elaborate on this here.

Page 7 Line 8: depths used showed negligible root density, please add information on estimating root density in different depths to “Environmental and plant parameters”

Results This section is nicely written!

Page 8 Line 14: Consider exchanging figure numbers 3 and 4 to achieve ascending order of figures mentioned in the text.

Page 9 Line 12: correct “along with the lines of evaporation”

Page 9 Line 15: “Root water uptake allocation” sounds odd, Fig. 7 shows root water uptake from different depths over time but no allocation. Consider rephrasing.

Discussion The discussion could still be improved by further increasing the implementation of own results in the theories discussed and enhancing the clarity of some statements made.

Page 9 Line 28: remove “was”

Page 9 Line 29: add comma after “Mediterranean soils”

Page 9 Line 31: remove “significantly”

Page 10 Line 3: add “This is” before “in contrast”

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Page 10 Line 4ff: Dubbert et al. 2014 “reported beneficial effects of vegetation cover on soil water infiltration year-round” Fig. 2 in this paper shows indeed vegetation plots showing mostly higher infiltration than soil plots. However, it would be good to compare data specifically for the transition period between the wet and the dry year here. From Fig. 2 by Dubbert et al. 2014 one can infer that vegetation enhanced infiltration as compared to bare soil, particularly with large water pulses. The only data point comparable to your data shows a rain pulse of 10mm as compared to the 20mm you gave, with only little benefit of vegetation cover. Does that enhance or reduce the significance of your reversed results? In addition, how did you apply water? On the spot irrigation can hardly be expected to yield same infiltration results as a rainfall event over a certain amount of time? This may be good to discuss here.

Page 10 Line 13: “anyway” reword

Page 10 Line 14: add “by” after “unaffected”

Page 10 Line 16: “effects of soil hydraulic properties beneath tree crowns” In what way were properties affected? Did that also apply to your study? Please elaborate further on the potential importance of this.

Page 10 Line 17: remove brackets before reference to Bhark and Small, 2003

Page 10 Line 19ff: The positive effects of tree crown cover on infiltration may be lost by interception, as the authors state. Could you try to infer the role of interception for cork oak trees from literature values to better describe the significance of the climatic advantages in the shade for infiltration? Soares David et al., 2006 for example report 22% interception loss for cork oak. (David, et al., 2006 Rainfall interception by an isolated evergreen oak tree in a Mediterranean savannah, *Hydrological Processes*, 20, 2713-2726; maybe also of interest: Pereira et al., 2009. Modelling interception loss from evergreen oak Mediterranean savannas: Application of a tree-based modelling approach. *Agricultural and Forest Meteorology*, 149(3-4): 680-688.

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Page 10 Line 24: consider deleting “close to trees”

Page 10 Line 28: correct “overall”

Page 10 Line 29: reword “shortcoming”, odd in this context

Page 11 Line 10: odd “productive water”, consider rewording

Page 11 Line 11: rephrase to “. . . from the longer time response lag of T., on the other hand from only little event water reaching deeper soil layers, where. . .”

Page 11 Line 12: remove “prior to the precipitation pulse”

Page 11 Line 13: “Event water use of the understory vegetation was overall low” Again the question, of how much living biomass was there? Is it possible that understory plants were on the verge of senescence and therefore did not use the water or readjust water uptake depths?

Page 11 Line 18: “Competition with tree roots” This can this be inferred from $\delta^{18}O$ signals of soil water being more depleted in the tree site but this depletion not being visible in transpiration? Higher infiltration at the tree site must thus have been of no use for understory plants, because of competition with trees. Could you elaborate on this more?

Page 11 Line 22ff: “Hydraulic lift” This point is contrary to the previously discussed competition for water. If water from hydraulic lift was up in the layer of understory roots you would expect 1) a dilution of the event water signature, and 2) a higher soil moisture. You do not find any of this. Thus, I think from your data you can infer that hydraulic lift was not a major factor here. Roots preferentially taking up water in this depths may be due to hydraulic lift, but you find the same in the open site, so I would take out this argumentation here.

Page 12 Line 2: context: the use of “therefore” is not indicated, I suggest removal of this term

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Page 12 Line 8: remove “the” before “type”

Conclusions The conclusions at the moment seem overstated considering the results presented, and should be rewritten. The study itself is nice enough and does not need this thick laid conclusion.

Page 12 Line 13: I do not really agree that your study disentangled and quantified tree and understory interactions. As such you compared sites with and without trees, but do not go into much depth regarding tree understory interactions. For this statement to stand this topic should be more thoroughly discussed on base of the results presented. Either adapt the discussion to really try and disentangle the role of hydraulic lift vs. competition vs. enhanced interception, or be more modest here.

Page 12 Line 18: Consider removing “or just bare soil”

Page 12 Line 19: The sentence “Thus, the amount of unproductive water loss. . .” is a large overstatement and should be removed. This study did not show any data on nitrogen fixation, carbon sequestration or biomass production, for this statement to hold true.

Page 12 Line 21: I would not consider a 20mm precipitation pulse as light or medium.

Page 12 Line 22ff.: “Therefore, these understory plants were forced into competition. . . .However, the understory plants could profit from tree root induced soil water redistribution.” Both statements do not hold true, the first point I can agree upon, but it should be included in more detail in the discussion with better implementation of own results. The second statement, I don’t believe that this was shown!

Page 12 Line 23: “Cork oak trees foster infiltration. . . .” I would not make this statement without considering interception of rainfall.

Page 12 Line 26: that is too laid on thick, given the study’s outcome. I would not use this sentence.

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Please also note the supplement to this comment:

<http://www.biogeosciences-discuss.net/bg-2016-451/bg-2016-451-RC1-supplement.pdf>

Interactive comment on Biogeosciences Discuss., doi:10.5194/bg-2016-451, 2016.

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