

## ***Interactive comment on “Preferential water flow through decayed root channels enhances soil water infiltration: Evaluation in distinct vegetation types under semi-arid conditions” by Gao-Lin Wu et al.***

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### General comments

This manuscript (MS) looks into the effect of live and decaying plant roots on soil-water infiltration using a double-ring infiltrometer and dye solutions. Alas, this study is of uncertain quality and, in my opinion, needs substantial work before it can be considered further for publication in HESS and elsewhere. The study is not placed into context, as the wider body of related studies are not adequately mentioned or discussed, the

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existing knowledge gaps related to the study topic are not indicated nor addressed, the aim and objectives are not mentioned, and there is a severe lack of detail and justification throughout the MS, particularly in the methodology and results Sections. The latter issue has a knock down effect, making it unclear to the reader what the authors actually did, and ‘why’, how the results were collected, and more importantly, which results were actually retrieved to merit being published. As it stands, it seems like just a series of infiltration tests were undertaken with a clear, yet unexplained, deviation from standard, which derived into a series of results that in spite of being good and sensible, they are rather trivial and expected. A way forward for the authors would be: (i) to providing more detail, (ii) to place the study in context (i.e. knowledge gaps), (iii) to demonstrate how the study addresses some of the knowledge gaps with supporting information from the results, and (iv) stress the impact and application of the study. Please, see below some specific comments.

### Specific comments

#### Abstract

L.29 the scope/background of the study is not clear from the two first sentences - ‘phenomenon of dried soil layer’ is unclear and misleading L.33 the Latin/scientific names of the plant species do not match the common names L.34 bare land -> fallow conditions L.34 this is not introduced -i.e. the methodology must be summarised more clearly in the abstract, for which the authors could be more generic - e.g. infiltration tests using a dye under living and decaying vegetation. . . L.39 not clear here how/whether/why the root systems were described L.43 do you mean arid or water-limited ecosystems?

Professional proof reading is needed!

Also, there is a bigger picture here than the one proposed by the authors. This is related to the effect of land use change - e.g. woodland removal/clear cutting

Keywords

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L.45 surely the authors can choose better key words

## 1. Introduction

L.51 'the' soil-plant-atm continuum L.55 this sentence is not clear, also it is not clear how DSL is related to plant cover establishment, soil degradation, etc. a connection has to be made. It is hard to understand what the authors mean by 'recharge of soil water' in relation to the previous sentence, were the authors are referring to groundwater flow...? L.56 water infiltration is a hydrological process but groundwater isn't (it is a noun, not a process) - please clarify how groundwater may affect soil moisture L.57 macropores not defined

Preferential flow not defined

How plant roots may regulate preferential flow below ground is not explained or introduced

please, address these points

L.59 this sentence is not connected to the previous one - and it seems out of scope - i thought you were talking about plant roots and pref flow... L.63 all these sentences seem redundant - i.e. no new or clarifying information is provided, it seems like the authors are talking in circles - please, establish a logic structure in which concepts/ideas are introduced adequately to then elaborate further in the light of the scope of your study L.64 not clear what is the role of plant decay here or how it is species-specific L.65 root density is not defined and the sentence after the comma does not clarify the previous one L.66 studied alfalfa fields, with what aim? L.67 restoring water conditions to respect what previous state? L.68 why is this important? L.69 how this connects to land management? it is hard to understand how land managers can make use of soils with decaying roots, please elaborate L.71 do you mean vegetation type? L.75 how tree plantations can be a phenomenon? L.78 which plants? L.79 it is not clear how the channels may favour infiltration - preferential infiltration not defined yet L.84 citation

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missing L.86 what is soil water reservoir? did you mean soil water retention capacity? please, use words/concepts that are widely used/understood by the international scientific community

Also, citation needed L.87 methods of study not outlined

importance/impact of the study not outlined

knowledge gaps not outlined – the authors are not outlining the wider context in which this study rests

L.90 with what aim? L.95 not clear connection with this SDG - and i am sure the authors can also find other related subjects linked to their study?

As the main knowledge gaps are not outlined and as the authors are not pointing to the reader which is the relevance of the study, it is hard to understand what is the relevance of this study. Having read the methodology, this study does not seem to be cutting edge or addressing a major knowledge gap in the field of study.

A review on woks focusing on preferential flow carried out in Europe and USA is not provided at all...while i am aware there is a relative big number of existing studies

## 2. Materials and Methods

L.98 is there more than one study site? L.100 Coordinate Reference System? L.101 what is the precise elevation of the study site? L.101 what kind of restoration was this? L.102 could you provide the time period used to obtain the mean climatic attributes? if someone reads this work in the future, this will help to understand how the climate has changed over time L.104 did the soil had any gravel or coarser materials at all? could you also provide soil classification according to textural class? which were the hydrological features of the soil - e.g. saturated hydraulic conductivity, soil moisture at field capacity and at wilting point, porosity, bulk density...without more information for the soil under study, the results will be very hard to interpret or reproduce. L.105 could you provide the Koppen classification code for this cliamte?

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Why the 'sloping lands' were degraded?

please replace 'sloping lands' with a more appropriate word

L.110 please, provide a justification for selecting these plant species

Also, *Medicago sativa* is not a grass - it is a herb

L.113 which old and which new data? this is very confusing - also it is not clear which data/which variables/why these variables, etc.

if you did not collect the info for Alfalfa, but you are reproducing the same conditions here than in a previous experiment for comparison purposes, you still need to give detail about the experiment -i.e. you cannot expect the reader to read two papers to understand one study. . . L.113 Do you mean fallow? L.114 how many? how old? how did you select them?

L.116 what do you mean by artificial?

L.119 repeats L.119 were all individuals close to each other?

How the soil properties were characterised is not clear? L.120 why there is an uneven number of repeats? L.123 did the authors undertake the experiment according to standard? if so, which protocol did they follow? L.124 could the authors provide a picture of the infiltrometer ring as suppl material? 1 cm wall thickness is quite thick. Was the ring inserted in the ground? if so, to which depth? The dimensions of the infiltrometer are not standard - could the authors justify this? deviations from standard should always be noted in the text L.127 how did you proceed to remove the trees and shrubs?

how did you know which root system was underneath? how did you know whether was still alive or decaying? L.128 the authors must explain and justify why a dye was used in this experiment L.128 why dye was not applied to the outer ring? - also, is not the outer ring used as a buffer -i.e. The purpose of the outer ring is to have the infiltrating water act as a buffer zone against infiltrating water straining away sideways from the inner

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ring; so why different coloured water was employed. L.129 it is not clear/explained how much or to which level the rings were filled with water; were the rings refilled? if so, how? at what rate? L.132 why? L.133 no results should be presented in this Section L.135 if soil moisture was measured 24 h following infiltration, it is very likely that the authors measured the field capacity L.137 why 24 hours? L.138 the soil profiles are not shown in Fig. 1 - Fig.1 is showing drawings with annotations L.138 this step is unclear - more detail is needed - did you use a measuring tape, a gridded sheet + drawings, images. . . L.139 how did you identify the wetted area? L.140 why these depths? L.142 did the authors measure soil moisture over time and carry out the experiment under different degrees of saturation? in my experience, preferential flow tends to be more significant near saturation but this has not been convincingly studied and deserves more attention. Could the authors address this point? L.144 did the authors measured the particle density or was it assumed? L.147 how the root channels were identified?

How many dimensions were used? L.148 why did the stubbles were measured? L.149 it is hard to understand how the root channels in the inner ring were quantified/recorded L.152 this is very incomplete and does not provide enough info to understand the study and/or reproduce it L.158 why ANOVA, were the variables tested normally distributed? was this checked at all? L.159 significance level is either 99 or 95 %

### 3. Results

L.165 are these results shown anywhere in the MS? -e.g. Table or Figure? L.166 the variables need to be spelt out at the beginning of the Section, so the reader does not have to go back. . . L.166 how the soil layers were divided? where is this explained? L.175 this sentence is not clear

Also, where are these results shown? L.175 this bulk density seems too high for vegetated soil. . .were the authors aware of any compaction or wetting-drying cycles which may be related to these levels of bulk density? L.184 it is hard to digest these results - with respect to what the infiltration rate increased? was it higher under living or decay-

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ing roots? the authors must be very clear about the results and make sure the most relevant ones are highlighted L.190 where are the results for ARCD and RCA shown?

#### 4. Discussion

L.201 the text in this para belongs in the introduction L.211 as it is not clear how ARCD and RCA were measured, nor the patterns of preferential flow, wetting area in the soil, these results are not very convincing. More detail is needed everywhere in this MS L.212 was macropore flow explicitly measured? L.214 this is not clear nor why it is environmentally relevant L.219 any ideas why? this needs to be explained further L.221 which one is this? did you mean formation of perched water tables? - again this text seems to belong in the Introduction L.224 where is this shown? L.226 the purpose of using a dye is not explained - nor the results shown L.230 i presume that there is a long list of studies reporting similar findings? however these are not listed anywhere L.232 steady and transient infiltration has not been defined or introduced It would be good that the process of infiltration and theories such as Norton or Green&Ampt were at least overviewed or mentioned to place this study in context L.233 'The' results L.234 these results have not been presented in Section 3 L.237 not clear how the findings gathered here can help to shed light on this L.239 study limitations or future work not mentioned

also the study is not framed in the wider body of international studies..

L.352 Fig. 4 the results are good but they seem obvious/trivial - i.e. it is well know that plant roots contribute to increase soil infiltration - macropores, structure changes, etc. have been widely reported. I am not familiar with many studies looking into decayed and living roots - yet i remember well a study from 2013 published in EcolEng by Federico Preti- Forest protection and protection forest: Tree root degradation over hydrological shallow landslides triggering. Ecological Engineering

figure caption is behind the figure so it cannot be read

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2020-266>, 2020.

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