

Responses to reviewer 2 Comments

(original comments by reviewers are in blue color)

1. Comment: This study combined water isotope and physiological measurements to quantify ecohydrology processes of two main conifers in subtropical China. The authors found that plant water uptake is homogeneous between habitats, and water uptake depths switched from shallow soil layers in early-season dry period to deep ones during the late wet season with amply precipitation. The findings are timely and will provide insights into forest management in subtropical China, where climate extreme is increasing in recent decades. However, (1)the whole text needs to be thoroughly edited and checked. (2)In addition, the language editing by a native speaker is required.

Response: Thanks for the advice.

(1) We revised the whole manuscript according to the review advice.

Introduction: we added the references of the plant water sources using isotope technology. The different habitat characteristic and significance were added in L.86-89 (in the revised version). And the objectives and hypothesis were reviewed more specific.

Materials and methods: The habitat photos and location map was added in Fig. 1. The sample trees could represent the stand level because they are chosen according to different diameter classes and closed to the average DBH in the stand. The information of soil bulk density was added in Table 1(in the revised version)

Results: The isotope analysis of soil water, spring water and xylem water was re-written in the new version. The leaf water potential was revised more logically. And we moved the water use efficiency into 3.4 part.

Discussion: We omitted some parts that were too specific, such as 4.1 part L.411-420 and 4.3 part L. 477-479, L.481-482 in the previous version.

Abstract and Conclusion: We revised them more logically.

Besides, we checked the grammar and improper expression through the manuscript.

(2) The manuscript has undergone English language editing by MDPI, which uses experienced, native English speaking editors..

2. Comment: L31-32, which species respectively show growth restriction and hydraulic failure?

Response: Thanks for the advice. During the long drought in growing season, *C. lanceolata* will suffer the growth restriction and *P. Massoniana* will suffer hydraulic failure. We revised is as:

Furthermore, during the long drought in the growing season, we observed probable divergent responses of *C. lanceolata* and *P. massoniana*, such as growth restriction for the former and hydraulic failure for the latter.

The main reasons according to our results are as follows:

Because *C. lanceolata* showed the relatively less negative midday leaf water potential and stable diurnal water potential ranges, which mean the strict stomata control. While *P. massoniana* exhibited higher $\Delta\Psi$, and negatively associated with antecedent precipitation. They both mainly absorbed shallow layers water.

Once the long drought happens in the growing season, the soil water will decrease. And the stoma of *C. lanceolata* could close for maintaining the leaf water potential, resulting the low carbon sequestration and restriction of growth. While *P. massoniana* could exhibit more negative leaf water potential for obtaining more water, resulting the xylem cavitation and embolism and hydraulic failure.

3. **Comment:** L54-55, Tree species may switch their water sources from shallow layers in wet season with sufficient precipitation to stable layers in dry season.

Response: Done

4. **Comment:** L59, Other plants, however, mostly...

Response: Done

5. **Comment:** L62, characteristics

Response: Done

6. **Comment:** L79, Subtropical China characterized by a monsoon climate is an ecologically sensitive area under global change.

Response: Done

7. **Comment:** L87-90, While the authors stated the importance of investigating plant water uptake in different habitats, (1)what are the specific differences (elevation, soil type or tree species etc.) in Habitat was not introduced and (2)why they are important for vegetation restoration.

Response: Thanks for the advice.

(1) The specific differences in habitat mainly referred to the distinction of rock and soil structure, such as the thin soil habitat with rock fragments, or the outcrop habitat with soil fragments, and so on. We added the specific differences in L.89-91.

(2) The importance of plant water use study in different for vegetation is as follows:

Different rock and soil structures could influence hydrological processes and the amount of soil water available. Plant water use strategies in different habitats are critically important for the evaluation of vegetation adaptation. A number of previous studies have primarily focused on the water sources of different types of plantations or natural vegetation in one specific habitat [16,35]. Few have paid attention to differences in plant water uptake patterns in different habitats, which has limited our understanding of plant water adaptation and the evaluation of sustainable vegetation restoration.

We revised it in L.91-98.

8. Comment: L92, I would suggest summarizing the related researches using isotopic methods to quantified plant water uptake (at least in the study areas).

Response: Thanks for the advice. We summarized the related plant water sources researches based on the isotope technology in L.58-67.

9. Comment: L95-102, The Objectives and Hypotheses are more general, which need to be improved.

Response: Thanks for your advice. We revised the objectives and hypotheses more specific as follows:

The main objectives of this study were: (i) to investigate the responses of

belowground water use patterns of *Cunninghamia lanceolata* and *Pinus massoniana* to the temporal–spatial heterogeneity of water availability, as shown in conditions of different antecedent precipitation levels and edaphic and rocky habitats; and (ii) to understand the aboveground physiological responses to varied water availability of two species, analyzed by examining the variations in leaf water potential behavior and water use efficiency. Our first hypothesis was that soil water availability could have an effect on the plant water uptake depth, and that the two species may show similar water sources, and the second was that the plants' physiological factors may vary with the changes in water availability and species types.

10. **Comment:** L108-110, The wet season, which receives more than 60% of annual rainfall, lasts from late April to late September, and the dry season extends from December to February.

Response: Done

11. **Comment:** L118-130, As authors stated in the method, the habitats are mostly related to soil type. However, to make readers more easily understand the contrasting habitats, habitat photographs and its spatial distributions in the studied area need to be added in Figure 1.

Response: Thanks for the advice. We added the habitat photographs and its spatial distributions in the study area in Figure 1.

12. **Comment:** L157-158, Did the DBH of sampled trees represent the average DBH in the stands?

Response: Thank you for your advice. The average DBH of the *C. lanceolata* and *P. massoniana* are 7.6cm and 8.5cm in the stands. We classified the DBH of the two species as three diameter classes as Table1:

Table 1 The diameter classes and numbers of trees (cm)

Number	<i>C. lanceolata</i>			<i>P. massoniana</i>		
	Diameter class (cm)	Numbers		Diameter class (cm)	Numbers	
		Edaphic habitat	Rock habitat		Edaphic habitat	Rock habitat
1	5-7	16	15	6-8	8	11
2	7-9	28	25	8-10	35	32
3	9-11	9	10	10-12	8	7

The DBH of the sampled trees are as Table 2, which could represent the average DBH in the stands.

Table 2 The DBH of sampled trees (cm)

Number	<i>C. lanceolata</i>		<i>P. massoniana</i>	
	Edaphic habitat	Rock habitat	Edaphic habitat	Rock habitat
1	6.5	6.7	7.1	7.2
2	7.2	7.2	8.2	8.1
3	7.8	7.9	8.9	8.3
4	10.1	10.5	11.1	10.2
Average	7.9	8.1	8.8	8.5

13. **Comment:** L162-166, Citations are required.

Response: Thank you for your advice. The citations has been referred in L. 185 in the manuscript.

14. **Comment:** L175, Information soil bulk density are missed here.

Response: Thank you for your advice. The information of soil bulk density has been added in L.197 Table 1.

15. **Comment:** L209, what is the meaning of ‘2/3 of the way up of the canopy’?

Response: We sampled the mature leaf and branches that must be fully exposed to the sun. The places where branches was located at the 2/3 height of the total canopy could meet the conditions. We have revised as “Samples (n= 5 per species) were collected from branches that were fully exposed to the sun, at places where branches were 2/3 of the way up of the canopy, at least 2 m above ground.”

16. **Comment:** L217-218, I doubt the statements of no isotopic discrimination of water between plant and soil water, especially for the current studied species.

Response: Thank you very much. There maybe isotopic discrimination of water in soil due to the evaporation. But the isotope fractionation was usually not considered through the root water uptake and transport in xylem, apart from in halophytes (Walker et al., 2001; Wang et al., 2020). In our study, the two species are not halophytes. Besides, we sampled the root and xylem and measured the water isotope of these two organs of *C. lanceolata* in 2021 in the next manuscript. We found that there were no significant differences in δD and $\delta^{18}O$ of water between root and xylem

($p > 0.05$). Considered the two aspects, we set the discrimination was zero.

Walker, C.D., Brunel, J.P., Dighton, J., Holland, K., Leaney, F., Mc, E.K., Mensforth, L., Thorburn, P., Walker, C., 2001. The use of stable isotopes of water for determining sources of water for plant transpiration. In: Unkovich, M., Pate, J., McNeil, A., Gibbs, J.D. (Eds.), *Stable Isotope Techniques in the Study of Biological Processes and Functioning of Ecosystems*. Kluwer Academic Press, Dordrecht, pp. 57–89.

Wang, J., Fu, B.J., Wang, L.X., Lu, N., Li, J.Y..2020. Water use characteristics of the common tree species in different plantation types in the Loess Plateau of China. *Agr Forest Meteorol*, 299-289: 108020.

17. Comment: L230, what is ‘no effective rainfall’?

Response: Thanks. We mean that there were no effective precipitation records before the first 20 days of sampling in May. Before the first sampling, there were three rainfall events in May 8, 10 and 12, 2020. But the precipitation was only 0.6, 0.2 and 0.2, respectively and last for only one or two hours. The rainfall was too light to infiltrate to the catchment and just evaporate (Ali & Mubarak, 2017), and we did not collect the precipitation samples and ignored them.

Ali M, Mubarak S. 2017. Effective Rainfall Calculation Methods for Field Crops: An Overview, Analysis and New Formulation. *Asian Research Journal of Agriculture*, 7(1):1-12.

18. Comment: L263, I would suggest inseting date in each panel rather than in the

caption.

Response: Thanks for your advice. We inset the sample date in each panel in Fig. 3, Fig.4, and Fig. 5.

19. Comment: L270, Did the average VWC differ significantly between habitats.

Response: We compared the VWC in layers and found that the VWC showed significantly differences in the shallow layers between two habitats. While, the middle and deep soil moisture showed no significant differences in the two habitats.

Since the plant water use was influenced mainly by the shallow layers moisture, the different soil water available may be affect the plant water uptake proportion.

Besides, we analyzed all sample layers of VWC between two habitats by the independent-samples T test and found that there were no significant differences ($p = 0.07$).

And we revised the expression as: “The average VWCs were $43.42 \pm 7.68\%$ in edaphic habitat and $38.24 \pm 8.42\%$ in rocky habitat with no significant differences ($p=0.07$) during the study periods. ”

20. Comment: L283-284, The meaning of this sentences is unclear.

Response: We mean that the two species utilized different layers of soil water with seasonal changes. But the water sources proportion of two species had no significant differences ($p > 0.05$). We revised the expression as: “However, the plant water uptake depth differed between habitats and across seasons.” in L. 317-318.

21. **Comment:** L282-293, This paragraph and elsewhere in RESULTS needs to be rewritten to convey the findings in logical ways. According to Figure 6, the water uptake depth did not differ between species irrespective of the habitats, whereas they did differ between habitats and across seasons.

Response: Thank you for your advice. Indeed, the water uptake depth did not differ between species irrespective of the habitats, whereas they did differ between habitats and across seasons. And we highlighted the differences between habitats and across seasons. The revised paragraph are as follows:

The two tree species mainly took up soil moisture throughout the wet season in two habitats, and the proportions of water sources used by the two species exhibited no significant differences ($p > 0.05$) (Fig.6). However, the plant water uptake depth differed between habitats and across seasons. In HP, trees in the rocky habitat absorbed more than 67.14% of their water from shallow soil layers, whereas the mean water uptake ratio of the two tree species in the edaphic habitat were 64.45% for the middle and deep soil layers. In DP, the *C. lanceolata* and *P. massoniana* in edaphic habitat obtained more than 74.82% of their water from the shallow and deep soil layers. On the other hand, in the rocky habitat, the two species mainly extracted soil water from shallow and middle layers (82.13%). In NP and LP, both *C. lanceolata* and *P. massoniana* in the two habitats utilized the largest proportion of shallow soil water (64.97%, 0–30cm).

22. **Comment:** L330-339, (1)What is ‘diurnal range of water potential’? (2)Diurnal variations in water potential may also affects by atmospheric drought (i.e., VPD). In fact, according to Table 2, plant water uptake depth is not correlated with diurnal range of water potential.

(3)The relatively roles of VPD and soil drought on plant water status should be quantified.

Response: Thanks for your advice.

(1) The diurnal range of water potential is the difference value between predawn and midday water potential.

(2) As the reviewer said, the high vapor pressure deficit and solar radiation mean strong atmospheric evaporation force (AEF) (Table 1) that influenced transpiration and the diurnal changes of water potential. In our study, the ψ_{md} was lower than ψ_{pd} , indicating the important role of VPD for plant water status.

(3) Besides, the meteorological factors during the sample period had no significant variation ($p > 0.05$), except DP with lower AEF. While the $\Delta\psi$ had seasonal changes and showed the highest values in NP and DP for the two species. These changes may be affected by the soil water available. And we further analyzed the relation between $\Delta\psi$ and precipitation and found that the $\Delta\psi$ of *C. lanceolata* did not increase from no rain to high rainfall in two habitats. While the $\Delta\psi$ of *P. massoniana* had significantly negative correlations with the precipitation increases in the edaphic and rocky habitats. The water potential behavior to precipitation was influenced by the species types.

23. Comment: L341, please explain Rda. and Roc in Figure 7.

Response: Thanks for your advice. We updated the more specific legends (Fig. 9 in the revised version). Eda. represents edaphic habitat; Roc. represents rocky habitat.

24. Comment: L353, define shallow, middle and deep layers.

Response: Thanks for your advice. We defined the shallow, middle and deep layers in 2.1 Study sites part of L.158-166. Thus, we used the three layers as water sources directly.

25. **Comment:** L375 &L379, delete 'For one thing' and 'For another'.

Response: Done

26. **Comment:** L394, wrong unit for carbon isotopic values in Table 3.

Response: Thanks for your advice. We revised the unit as “‰”.

27. **Comment:** L383-390, The authors attributed plant water uptake from shallow soil depth to energy saving strategies. However, direct links between measured iWUE and plant water uptake depth are missing according to the current measurements and explanations.

Response: Thank you for the advice. We added seasonal variation of the leaf $\delta^{13}\text{C}$ in the Results 3.4 part. And we found that the leaf water use efficiency was significantly higher in the drought stage (May-NP) than that in other stages ($p < 0.05$), indicating that the high iWUE affected the plant absorbed shallow layers water in the early wet season with 20-day drought. We revised this discussion in L.425-431.

28. **Comment:** L435, change 'different' to 'difference'

Response: Done

29. **Comment:** L442-445, Again, the contrasting eco-physiological between species may cause by atmospheric drought.

Response: Thanks for your advice. In Results 3.3 part, we added the variation of

meteorological factors during the samples. VPD and PAR are the main driving forces for plant transpiration and leaf water potential changes. But the two species were in the same environment influenced by the similar atmospheric drought. They showed the different water potential behavior, i. e. eco-physiological, indicating the different response for the atmospheric drought determined by the genetic factor. Specifically, the coexisting plants in the ecosystem scale can exhibit different degrees of leaf water potential behavior that maybe influenced by the species hydraulic trait and transpiration dynamics (Hochberg et al., 2018).

Hochberg, U., Rockwell, F.E., Holbrook, N.M. and Cochard, H., 2018.

Iso/Anisohydry: A Plant-Environment Interaction Rather Than a Simple Hydraulic Trait. *Trends Plant Sci*, 23(2): 112-120.

30. Comment: L463, this is a speculation, not the finding of this study.

Response: Thanks for the advice. We revised this sentence as: “plants absorbed soil water from shallow layers by increasing the diurnal ranges of water potential and water use efficiency in the early wet season with a 20 day drought. ”