Response to Reviewer #2, re: "Reduced transpiration without changes in root water uptake patterns in degraded trees in semi-arid afforestation ecosystems", in the review in HESSD (NO. hess-2023-66).

We thank Reviewer #2 for thoughtfully and critically reviewing our manuscript. We greatly appreciate the detailed and thoughtful points that have certainly helped us to improve the manuscript. Overall, we agree with these suggestions and have made targeted amendments, as described in the detailed point-by-point replies to the Reviewer’s comments below. The comments are cited in black. The response to each comment is presented in blue and passages changed in specific responses to the comments are presented in quotation marks and italic font.

Reviewer #2: The focus of this manuscript is the evaluation of the water-use strategies of *Populus simonii* trees under different degradation conditions. The authors combined the analysis of the root system, the isotopic composition (hydrogen and oxygen) of xylem and soil water, soil water content and sap flow to test whether degraded trees used less deep soil water compared to non-degraded trees.

The topic of this manuscript is potentially interesting for the readers of Hydrology and Earth System Sciences, and the paper is generally well written, even though I recommend a revision of the English by a native speaker. Besides this, I have some comments that would require a major revision of the text. First, the authors should clearly present the general objective and novelty of their work (this should be emphasized in the discussion and the conclusions as well). Secondly, the authors should specify some more methodological details and discuss the limitations of their study (please see the specific comments). Thirdly, the authors should consider restructuring the results, by starting from the presentation of the physical characteristics of the trees and the root systems, then by describing soil moisture and sap flow dynamics, and finally by presenting the quantification of the contribution of soil water at different depths to xylem water.

Reply

Before submitting this article, we asked the agency of Wiley Editing Services for English polishing services. We apologize that the previous edit was unsatisfactory. We're looking for a native speaker to check the English again. The specific changes will appear in the revised manuscript.

We will add a conceptual figure to the Discussion section to present the general objective and novelty of the work. See response to specific comment 6 for details. Some modifications are as follows:

"*To clarify the mechanisms of tree degradation or mortality and direct future silvicultural practices toward sustainable development of plantations, it is critical to be aware of how these degraded trees modify their water-use strategies (transpiration, root water uptake patterns, and* WUE_i*). As summarized in Fig. 9, tree transpiration significantly decreased with intensified degradation,* ($P<0.05$)*. The higher the degradation degree, the lower the DBH, crown width, and root biomass of the tree (Fig. 1, Fig. 2, and Fig. 9), and the less water needed for tree growth. Reduced water demand of degraded trees facilitated deep soil moisture storage (Fig. 3 and Fig. 9). These findings support our original hypothesis. However, the hypothesis that the relative contribution of deep soil water reduces with increased tree degradation was rejected. The root water uptake patterns were similar in terms of both time and depth in the ND, LD, and SD sites (Fig. 7a and Fig. 9)*" in Discussion section 4.2.

"*In conclusion, our findings imply that degraded and no degraded trees in water-limited areas adopt substantially varied water-use strategies. No degraded trees can utilize more deep soil water storage through a developed deep root system during the dry period; degraded trees can enhance their drought adaptability by improving* WUE_i *under soil water stress. However, the high water demand of artificial arboreal forests under normal conditions may threaten deep soil water reservoirs. Therefore, stand management, including appropriate thinning and mixed tree-shrub patterns, may be necessary to improve soil moisture conditions*" in the Conclusions section.

We will specify some more methodological details and discuss the limitations of our study. See response to specific comments 1, 2, 3, and 5 for details.

We will restructure the Results section. See response to specific comment 4 for details.

Specific comments

1. Section 2.3: The authors should clearly report in the text the number of samples (soil and plants) collected for isotopic analyses in each site and for each sampling date. To improve the clarity of the results, sample size (n) should be always reported in tables (e.g., Tables 1 and 2) and figures (or in their caption), and in the presentation of the results of statistical analyses.

Reply

To clearly report the number of samples (soil and plants), we intend to revise the sentence as follows:

"*We collected three xylem and leaf samples at each site and on each sampling date, and a total of 45 xylem samples and 45 leaf samples were collected during the observation period*".

"*The sampling depth was 0–200 cm, and the sampling intervals were 10 cm and 20 cm at the depth of 0–20 cm and below 20 cm, respectively. We collected 33 soil samples at each site and on each sampling date, and a total of 495 soil samples were collected during the observation period*".

To improve the clarity of the results, we will report the sample size (*n*) in tables and figures (or their captions) as well as in the results of the statistical analysis, with some modifications as follows:

Table 1 Basic characteristics of *P. simonii* at different sampling sites

Growth status	Tree height (m)	Spike top height (m)	Spike top ratio (%)	DBH (cm)	A_c (m^2)	Crown density (%)
ND	10.3 ± 1.3a	0a	0a	19.2 ± 3.8a	10.3 ± 3.4a	83.4 ± 13.2a
LD	9.3 ± 1.0a	2.6 ± 0.4b	28.0 ± 3.5b	15.4 ± 2.1b	9.0 ± 1.9a	72.0 ± 9.5a
SD	5.9 ± 0.8b	2.7 ± 0.3b	45.8 ± 3.1c	12.5 ± 1.6c	5.9 ± 1.5b	47.2 ± 8.4b

The DBH and A_c represent diameter at breast height and canopy projection area, respectively. Values are shown as the mean ± standard deviation. The number of samples (*n*) was 128 for the tree growth indicators, except for canopy density ($n=4$). Different lowercase letters indicate significant differences in tree morphological indicators among different sampling sites ($P<0.05$), based on the Tukey HSD post hoc test in One-way ANOVA.

Table 2 Mean δ^2H and δ^{18}O in the soil and xylem water of *P. simonii* during the growth season

Sampling site	Shallow soil water	Middle soil water	Deep soil water	Xylem water

δ^{2}H (‰)	ND	–48.71 ± 17.32	–64.09 ± 4.94	–73.88 ± 3.12	–58.43 ± 12.00
	LD	–50.11 ± 18.43	–65.53 ± 6.89	–75.90 ± 4.14	–61.85 ± 13.02
	SD	–52.54 ± 18.43	–59.65 ± 8.15	–72.32 ± 3.16	–59.97 ± 11.75
δ^{18}O (‰)	ND	–3.89 ± 3.62	–7.53 ± 0.82	–9.18 ± 0.62	–7.28 ± 1.11
	LD	–3.76 ± 4.11	–7.66 ± 0.94	–9.45 ± 0.65	–7.70 ± 1.10
	SD	–4.05 ± 3.64	–6.86 ± 1.03	–8.85 ± 0.49	–7.07 ± 0.85

Values are shown as the mean ± standard deviation (*n*=5).

Figure 2: Horizontal and vertical root distributions of *P. simonii*. The box plots show the minimum, 25% percent, median, 75% percent, and maximum of root weight density at 50, 100, and 200 cm from the trunk in the 0–200 cm soil profile, and black squares indicate the mean (*n*=33). The inset shows a properly enlarged vertical root distribution on the X-axis. Error bars show the standard deviation (*n*=3).

Figure 3: Temporal variations in daily precipitation (Pr), δ^{2}H-δ^{18}O in precipitation (a), and SWC at various depths (b–d). The SWC in May is obtained from the soil gravimetric water content and soil bulk density. The box plots show the minimum, 25% percent, median, 75% percent, and maximum of soil water content, and squares indicate the mean (*n*=122). Different lowercases in the box plots denote a significant difference in SWC of the same soil layer among the sample sites (P<0.05). The orange arrows correspond to the sampling dates of soil and plant isotopes.

Figure 5: Seasonal variations in δ^{2}H (a) and δ^{18}O (b) in the soil and xylem water. Values are shown as the mean ± standard deviation (*n*=3).

Figure 6: Average transpiration of degraded *P. simonii* from June to September (a), Seasonal variation in transpiration and REW (b–d). Tr and REW represent transpiration and relative extractable water, respectively. The box plots show the minimum, 25% percent, median, 75% percent, and maximum of transpiration, and black squares indicate the mean (*n*=120). Different lowercases in the box plots denote a significant difference in Tr among the sample sites (P<0.05).

Figure 7: Seasonal variations in the contribution proportions of water sources (a), mean REW (relative extractable water) (b), and absolute consumption of water sources (c) to *P. simonii* water absorption. The absolute water consumption is the product of source water contribution proportions and monthly cumulative transpiration of *P. simonii*. Values are shown as the mean ± standard deviation. The number

of samples in Figures a and c is determined by the isotopic mixing model and varies from a few hundred to a few thousand. Sample sizes of REW in May-September were 2, 30, 31, 31, and 30.

Figure 8: Seasonal variations in the average leaf δ^{13}C (± standard deviation, $n=3$) of *P. simonii* (a) and their relationship with soil water content (b). Soil water content is the monthly average SWCs in the shallow (0–40 cm), middle (40–80 cm), and deep (80–200 cm) layers.

"*According to the SWC and soil water isotope values, three soil layers in the 0–200 cm profile with significant differences ($P<0.05$, $n=5$) in isotopic compositions were selected as potential water sources*".

"*No significant difference ($P>0.05$, $n=33$) in the average root weight density was found among the different distances from the trunk*".

"*The average root weight density in the 0–200 cm soil profile was 741.4, 559.8, and 446.3 g m^{-3} in the ND, LD, and SD plots. The differences between these plots were significant ($P<0.05$, $n=99$)*".

"*No significant difference ($P>0.05$, $n=122$) in the mean SWC of the shallow layer was found among the ND, LD, and SD plots*".

"*We found significant differences ($P<0.05$, $n=122$) in the average SWCs of the middle and deep layers among the ND, LD, and SD plots*".

"*The average Tr in the ND, LD, and SD plots were 0.93 ± 0.48, 0.65 ± 0.27, and 0.53 ± 0.26 mm d^{-1}, respectively, and the difference among them was significant ($P<0.05$, $n=120$)*".

"*The leaf δ^{13}C values of P. simonii in the ND, LD, and SD plots ranged from –27.54 ‰ to –26.93‰, –27.56 ‰ to –26.59‰, and –27.17 ‰ to –26.59‰, respectively (Fig. 8a), and thus did not show significant seasonal variation ($P>0.05$, $n=15$). The mean leaf δ^{13}C values in the ND, LD, and SD plots were –27.2 ± 0.2‰, –27.1 ± 0.4‰, and –27.0 ± 0.2‰, respectively, and significant differences were not found among them ($P>0.05$, $n=15$). A weak positive correlation ($P>0.05$, $n=15$) was observed between* *leaf δ^{13}C and SWC in the ND plot, whereas significant negative correlations (P<0.05, n=15) were observed between leaf δ^{13}C and SWC in the LD and SD plots*".

2. Line 157: More quantitative details about rainfall events (amounts, intensity, and duration), and how they were defined (time without rainfall) are needed.

Reply

In our study, we only collected daily-scale precipitation samples and precipitation amounts. Notably, each rainfall event could not have more than 4 h of consecutive precipitation-free periods. If there were multiple rainfall events in one day, their samples were combined into one precipitation sample. We will add some detailed precipitation sample information as follows:

"*Daily-scale precipitation samples and amount were obtained from May to September 2021 (n=15) using a rain gauge placed on the open ground ~1000 m away from the P. simonii sampling sites. Because light rainfall events (precipitation <3 mm in one event) only moistened a few centimeters of soil in the P. simonii plantation, we collected precipitation samples in 30-mL polyethylene bottles after each rainfall event with precipitation >3 mm, immediately sealed them with parafilm, and transported them to the laboratory for frozen storage. Notably, each rainfall event could not have more than 4 h of consecutive precipitation-free periods. If there were multiple rainfall events in one day, their samples were combined into one precipitation sample*".

3. Section 2.5: The authors should clarify whether the thermal dissipation probes were calibrated or not, and add the measurement uncertainty, as well as the estimation of uncertainty in terms of daily transpiration. Furthermore, it is unclear why the authors monitored sap flow in five trees that were not used for the collection of xylem water (this should be justified). What are the main physical characteristics of the trees chosen for isotopic sampling and how did they differ from the trees selected for sap flow monitoring?

Reply

We did not perform laboratory calibration on the newly purchased thermal dissipation probes, because several studies have found that laboratory calibration of sap flow for diffuse-porous species is not significantly different from Granier's empirical calibration (Granier, 1987). Using Granier's empirically calibrated formula can estimate transpiration in diffuse-porous trees but underestimate transpiration in ring-porous wood trees (Taneda and Sperry 2008; Bush et al. 2010; Ma, 2018). In this study, *P. simonii* belongs to diffuse-porous species (Dai et al., 2020).

Uncertainties in the measurement of sap flow using thermal dissipation probes arise mainly from differences in sap flow radial transport velocity in the sapwood and differences in sap flow densities between different orientations of the same tree. These uncertainties in sap flow measurements may lead to uncertainty in transpiration estimation. The objective of this study was to compare the transpiration and root water uptake strategies and their response to drought in *P. simonii* with different degrees of degradation. We used the same standard sensor to measure the sap flow velocity of the same species and used the same methodology to estimate the daily transpiration at the whole-tree scale. Therefore, the uncertainties in measurement and transpiration estimation can be ignored in this study.

A portion of the branches of the sample tree was cut each month when plant samples (xylem and leaves) were collected. The selection of these sample trees for sap flow measurements may affect the results of the observations. The morphological indicators of the sample trees used for isotopic sampling and sap flow monitoring were both close to the average of trees of each site in Table 1.

We will make the following adjustments to specify some more methodological details:

"*Notably, we did not perform laboratory calibration on the TDP-20, because several studies have found that laboratory calibration of sap flow for diffuse-porous species (i.e. P. simonii) is not significantly different from Granier's empirical calibration (*Bush et al. 2010; Dai et al., 2020b; Taneda and Sperry 2008*). Uncertainties in the measurement of sap flow using TDP-20 arise mainly from differences in sap flow radial transport velocity in the sapwood and differences in sap flow densities between different orientations of the same tree. These uncertainties in sap flow measurements may lead to uncertainty in transpiration estimation. Because we used the same standard sensor to measure the sap flow velocity of* *the same species and used the same methodology to estimate the daily transpiration at the whole-tree scale, the uncertainties in measurement and transpiration estimation can be ignored in this study comparing water-use strategies of P. simonii with different levels of degradation*".

"*We selected three sample trees at each fixed site as well as three soil profiles for isotopic sampling, and these sample trees had similar morphological indicators to the average of trees of each site in Table 1*".

"*To avoid the influence of the removal of branches on the sap flow measurement during isotopic sampling, at each sample site (ND, LD, and SD), the sap flow velocity of five trees close to the soil and plant sampling sites was continuously monitored using a thermal dissipation probe (TDP-20, Dynamax Inc., TX, USA) at 1.3 m above the ground on the north side from June to September in 2021 (P. simonii leaves fall extensively at the beginning of October). Data were recorded by loggers (CR-1000, Campbell Scientific, Utah, USA) in 30 min intervals. The height, DBH, and* A_c *of these sample trees were close to the mean of each sample site in Table 1*".

Granier, A.: Evaluation of transpiration in a Douglas-fir stand by means of sap flow measurements. Tree Physiol., 3, 309–320, https://doi.org/10.1093/treephys/3.4.309, 1987.

Taneda, H., and Sperry, J. S.: A case-study of water transport in co-occurring ring- versus diffuse-porous trees: contrasts in water-status, conducting capacity, cavitation and vessel refilling. Tree Physiol., 28, 1641–1651, https://doi.org/10.1093/treephys/28.11.1641, 2008.

Bush, S. E., Hultine. K. R., Sperry, J. S., and Ehleringer, J. R.: Calibration of thermal dissipation sap flow probes for ring- and diffuse-porous trees. Tree Physiol., 30, 1545–1554, https://doi.org/10.1093/treephys/tpq096, 2010.

Ma, C. K.: Study on the ecohydrological processes of black locust forest land on the loess plateau. Dissertation for Doctor Degree, Northwest A＆F University, 2018. (in Chinese)

Dai, Y. X., Wang, L., and Wan, X. C.: Frost fatigue and its spring recovery of xylem conduits in ring-porous, diffuse-porous, and coniferous species in situ. Plant Physiol. Bioch., 146, 177–186, https://doi.org/10.1016/j.plaphy.2019.11.014, 2020.

4. Lines 241-250: This text can be moved to Section 3.1 or to a new section about the dynamics of soil water content.

Reply

We accept the reviewer’s suggestion and will restructure the Results section. Firstly, we present the horizontal and vertical root distributions of *P. simonii* at each site, which are crucial physical characteristics of root water uptake of trees. The morphological indicators of the sample trees are presented in Table 1 of Section 2.2. Secondly, we describe soil moisture and transpiration dynamics in Section 3.2. Then, we characterize isotopic compositions of different water pools, which is a key part of the study of plant water-use sources using isotope mixing models and will be of interest to scholars in the field of isotope hydrology. Finally, we describe the quantification of the contribution of soil water at different depths to xylem water. Specific changes will appear in the revised manuscript.

5. Section 4: This section lacks some paragraphs about the main limitations of this study. For instance, the authors have not discussed how the methodological uncertainty in the extraction of xylem and soil water (by cryogenic vacuum distillation) might have affected their results and interpretation, especially in terms of the estimated contribution of soil water at different depths to xylem water.

Reply

Uncertainty in the extraction methodology of xylem and soil water may affect the results of isotope analysis and the calculation of the contribution proportion of soil water to xylem water at different depths. The most widely used approach for determining the ^{2}H and ^{18}O in plant and soil water is by first extracting water from soils and plants using the cryogenic vacuum distillation (CVD) method (Orlowski et al., 2018). Recent studies have challenged the interpretation of plant water isotopes obtained through CVD based on observations of a large ^{2}H fractionation. Based on a rehydration experiment, Chen et al. (2020) believed that the xylem water cryogenic extraction error could originate from a dynamic exchange between organically bound deuterium and liquid water during water extraction. However, Diao et al. (2022) observed that ^{2}H fractionation has an inversely proportional relationship with the absolute amount of water being extracted and the methodological uncertainties can be controlled when sufficiently high amounts of xylem water were extracted (>0.6 mL). In our study, all xylem water samples obtained through CVD were about 1.0 mL and the isotope fractionation during CVD extraction of water can be negligible. In addition, some studies have also questioned the CVD accuracy on the extraction of soil water, because the evidence that cryogenically extracted soil water is depleted compared to reference water was found. Wen et al. (2021) and Yang et al. (2023) found that the cryogenic extraction biases were positively correlated with soil clay content. Orlowski et al. (2018) believed that sandy soil was almost unaffected by cryogenic extraction biases. In our study, the soil texture at each site is sandy (USDA classification), and the granular composition is 95.7% sand, 3.2% silt, and 1.1% clay. Moreover, no isotopic offset between soil water and xylem water was found (Fig. 4). Overall, the methodological uncertainty in the extraction of xylem and soil water (by CVD) can be negligible in this study.

We will add the discussion of the methodological uncertainty in the extraction of xylem and soil water (by CVD) to Section 4.1, as follows:

"*Uncertainty in the extraction methodology of xylem and soil water may affect the results of isotope analysis and the calculation of the contribution proportion of soil water to xylem water at different depths. The cryogenic vacuum distillation (CVD) method is widely used to extract water from soil and plant xylem for isotope analyses (Orlowski et al., 2018). Based on observations of a significant* ^{2}*H fractionation, recent investigations have questioned the interpretation of plant water isotopes obtained through CVD. Chen et al. (2020) postulated that the xylem water cryogenic extraction error may arise from a dynamic exchange between organically bound deuterium and liquid water during water extraction based on a rehydration experiment. However, Diao et al. (2022) observed that* ^{2}*H fractionation has an inversely proportional relationship with the absolute amount of water being extracted and the methodological uncertainties can be controlled when sufficiently high amounts of xylem water were extracted (>0.6 mL). In our study, all xylem water samples obtained through CVD were about 1.0 mL and the isotope fractionation during CVD extraction of water can be negligible. Due to evidence showing that cryogenically extracted soil water is depleted relative to reference water, some* *researchers have also questioned the CVD's accuracy in extracting soil water. Wen et al. (2021) and Yang et al. (2023) found that the cryogenic extraction biases were positively correlated with soil clay content. Orlowski et al. (2018) believed that sandy soil was almost unaffected by cryogenic extraction biases. In our study, the soil texture at each site is sandy (USDA classification), and the granular composition is 95.7% sand, 3.2% silt, and 1.1% clay. Moreover, no isotopic offset between soil water and xylem water was found in Fig. 4. Overall, the methodological uncertainty in the extraction of xylem and soil water (by CVD) can be negligible in this study*".

Orlowski, N., Winkler, A., McDonnell, J. J., and Breuer, L.: A simple greenhouse experiment to explore the effect of cryogenic water extraction for tracing plant source water. Ecohydrology, 11, e1967, https://doi.org/10.1002/eco.1967, 2018.

Chen, Y. L., Helliker, B. R., Tang, X. H., Li, F., Zhou, Y. P., and Song, X.: Stem water cryogenic extraction biases estimation in deuterium isotope composition of plant source water. P. Natl. Acad. Sci. USA, 118, 33345–33350, https://doi.org/10.1073/pnas.20144 22117, 2020.

Wen, M., Lu, Y., Li, M., He, D., Wei, X., Zhao, Y., Cui, B., and Si, B.: Correction of cryogenic vacuum extraction biases and potential effects on soil water isotopes application. J. Hydrol., 603, 127011, https://doi.org/10.1016/j.jhydrol.2021.127011, 2021.

Diao, H., Schuler, P., Goldsmith, G. R., Siegwolf, R. T. W., Saurer, M., and Lehmann, M. M.: Technical note: On uncertainties in plant water isotopic composition following extraction by cryogenic vacuum distillation. Hydrol. Earth Syst. Sci., 26, 5835–5847, https://doi.org/10.5194/hess-26-5835-2022, 2022.

Yang, B., Dossa, G. G. O., Hu, Y. H., Liu, L. L., Meng, X. J., Du, Y. Y., Li, J. Y., Zhu, X. A., Zhang, Y. J., Singh, A. K., Yuan, X., Wu, J. E., Zakari, S., Liu, W. J., and Song, L.: Uncorrected soil water isotopes through cryogenic vacuum distillation may lead to a false estimation on plant water sources. Methods Ecol. Evol., 14, 1443–1456, https://doi.org/10.1111/2041-210X.14107, 2023.

6. The main findings of this study could be presented in a conceptual model and an accompanying figure/sketch.

Reply

We accept the reviewer's suggestion and will add a conceptual figure, as follows:

"*As summarized in Fig. 9, tree transpiration significantly decreased with intensified degradation,* ($P<0.05$)*. The higher the degradation degree, the lower the DBH, crown width, and root biomass of the tree (Fig. 1, Fig. 2, and Fig. 9), and the less water needed for tree growth. Reduced water demand of degraded trees facilitated deep soil moisture storage (Fig. 3 and Fig. 9). These findings support our original hypothesis. However, the hypothesis that the relative contribution of deep soil water reduces with increased tree degradation was rejected. The root water uptake patterns were similar in terms of both time and depth in the ND, LD, and SD sites (Fig. 7a and Fig. 9)*".

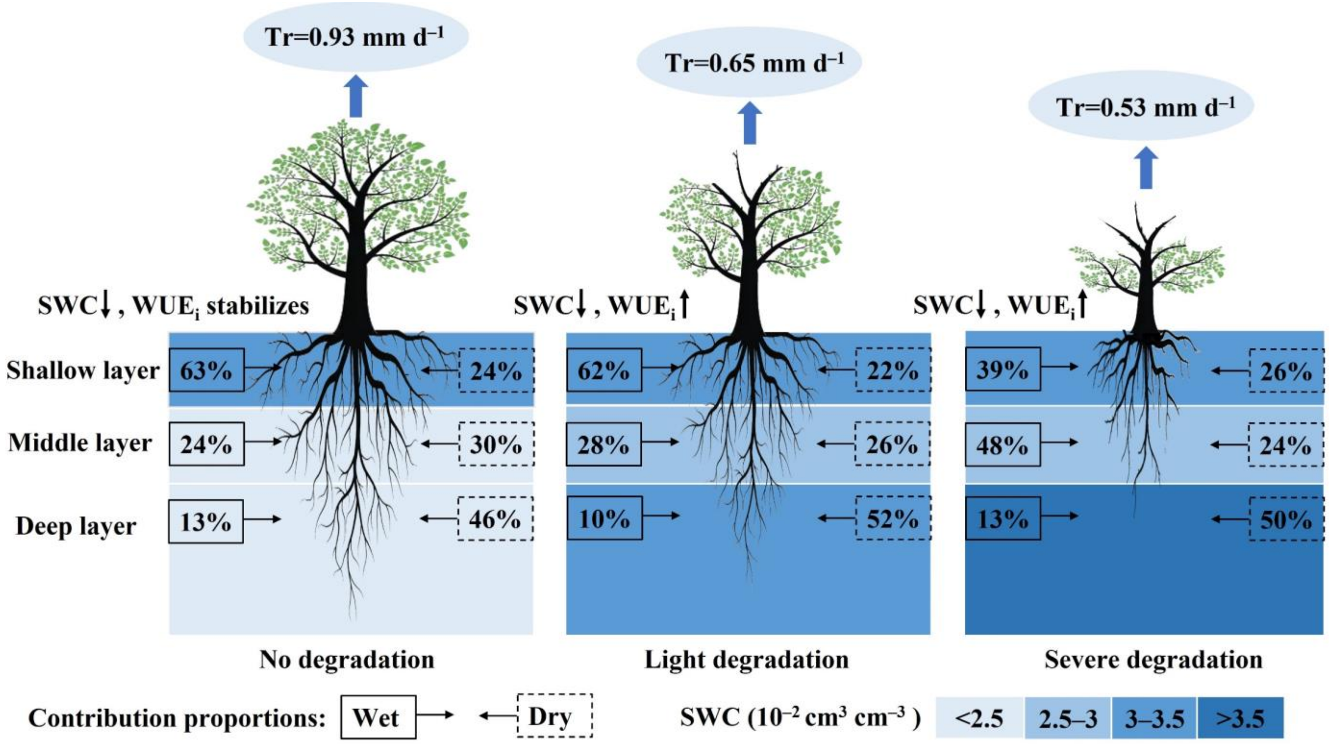

Figure 9: Graphical summary of tree morphological characteristics, soil water status, and water-use strategies under different degradation degrees of *P. simonii* during the growing period (May to September). The soil water content (SWC) and transpiration (Tr) in the figure represent the mean values

for each site during the growing period. The data in the solid and dashed boxes represent the average proportion of soil water used by trees in May (the wettest month) and September (the driest month), respectively. As the SWC decreases, the intrinsic water-use efficiency (WUE_i) in the no degradation site stabilizes, and the WUE_i in the light and severe degradation sites tends to increase.

7. Lines 435-436: I recommend reporting the description of the hypotheses here as well.

Reply

We accept the reviewer's suggestion and will report the description of the hypotheses here as follows:

"*Thus, our findings supported the hypothesis that the deep roots and transpiration of P. simonii decrease with increased tree degradation, which leads to a reduction in absolute use of deep soil water and thus a trend of increasing water storage in the deep layer. However, the hypothesis that the relative contribution of deep soil water reduces with increased tree degradation was rejected*".

Technical corrections

1. Line 6: Please delete 'method' and use 'stable isotopes'.

Reply

We agree with it. We will delete 'method' and use 'stable isotope'. The adjusted sentence is as follows:

"*To identify the changes in water-use strategies of degraded Populus simonii, the soil water content, hydrogen and oxygen isotopic compositions in the soil water and plant xylem water, carbon isotopic compositions in the leaf, and sap flow velocity of trees were continuously measured under various degradation degrees (no degradation, ND; light degradation, LD; or severe degradation, SD) during the 2021 growing season*".

2. Line 57: Techniques do not mature; I suggest rephrasing the current unclear sentence.

Reply

We accept the reviewer's suggestion and will rephrase the current unclear sentence, as follows:

"*Recently, stable isotopes (^{2}H, ^{18}O, and ^{13}C) have been extensively used in critical eco-hydrology topics, such as determining the spatiotemporal sources of water taken up by plants (Miguez-Macho and Fan, 2021), calculating the mean transit time of various hydrological components (Dai et al., 2022), estimating the source water contribution to root water uptake (Dai et al., 2020), and analyzing the intrinsic water-use efficiency (WUE_i) of a plant (Wu et al., 2022)*".

3. Line 70: Please delete 'technology' and use 'stable isotopes'.

Reply

We will amend the sentence as suggested:

"We can calculate the water consumption from soil water storage by coupling stable isotopes and thermal dissipation method (Granier, 1987), and then we can comprehensively grasp the relationship between trees and water, preventing further plantation declines".

4. Line 111: Please use 'plots' instead of 'quadrats'.

Reply

We will revise it in the next version as follows:

"Then, four 20 × 20 m^2 plots were set up in each site, and the growth indicators of all P. simonii were measured, including the tree height, spike top height, diameter at breast height (DBH), and canopy projection area (Ac, calculated by the crown width in the east-west and north-south directions). The canopy density of each site was obtained from the ratio of total A_c to total area".

5. Line 118: Please replace 'inferior' with 'lower'.

Reply

We will revise it in the next version as follows:

"However, the growth status of P. simonii in the other two sites was lower than that in the ND site to varying degrees, and the P. simonii trees exhibited a spike top".

6. Line 147: Please replace 'rate' with 'efficiency'.

Reply

We will amend it as suggested:

"*A cryogenic vacuum distillation system (Li-2100, LICA Inc., Beijing, China) was employed to extract water from the xylem and soil, and the water extraction efficiency was over 99%*".

7. Lines 256 and 259: Please replace 'scatter points' with another term.

Reply

We will change it to "data points", as follows:

"*With increasing depth, the data points of* δ^2H-δ^{18}O *for soil water gradually approached and clustered toward the LMWL in Fig. 4. The relationships of* δ^2H-δ^{18}O *for soil water (soil water evaporation line, SWL) in the ND, LD, and SD sites showed similar characteristics (ND:* $\delta^2H=4.29\delta^{18}O–33.21$, $R^2=0.81$; *LD:* $\delta^2H=4.29\delta^{18}O–34.59$, $R^2=0.87$; *SD:* $\delta^2H=4.05\delta^{18}O–35.77$, $R^2=0.82$). *The data points of* δ^2H-δ^{18}O *for xylem water matched those for soil water in the dual-isotope space (Fig. 4), thus implying a lack of apparent deuterium depletion*".

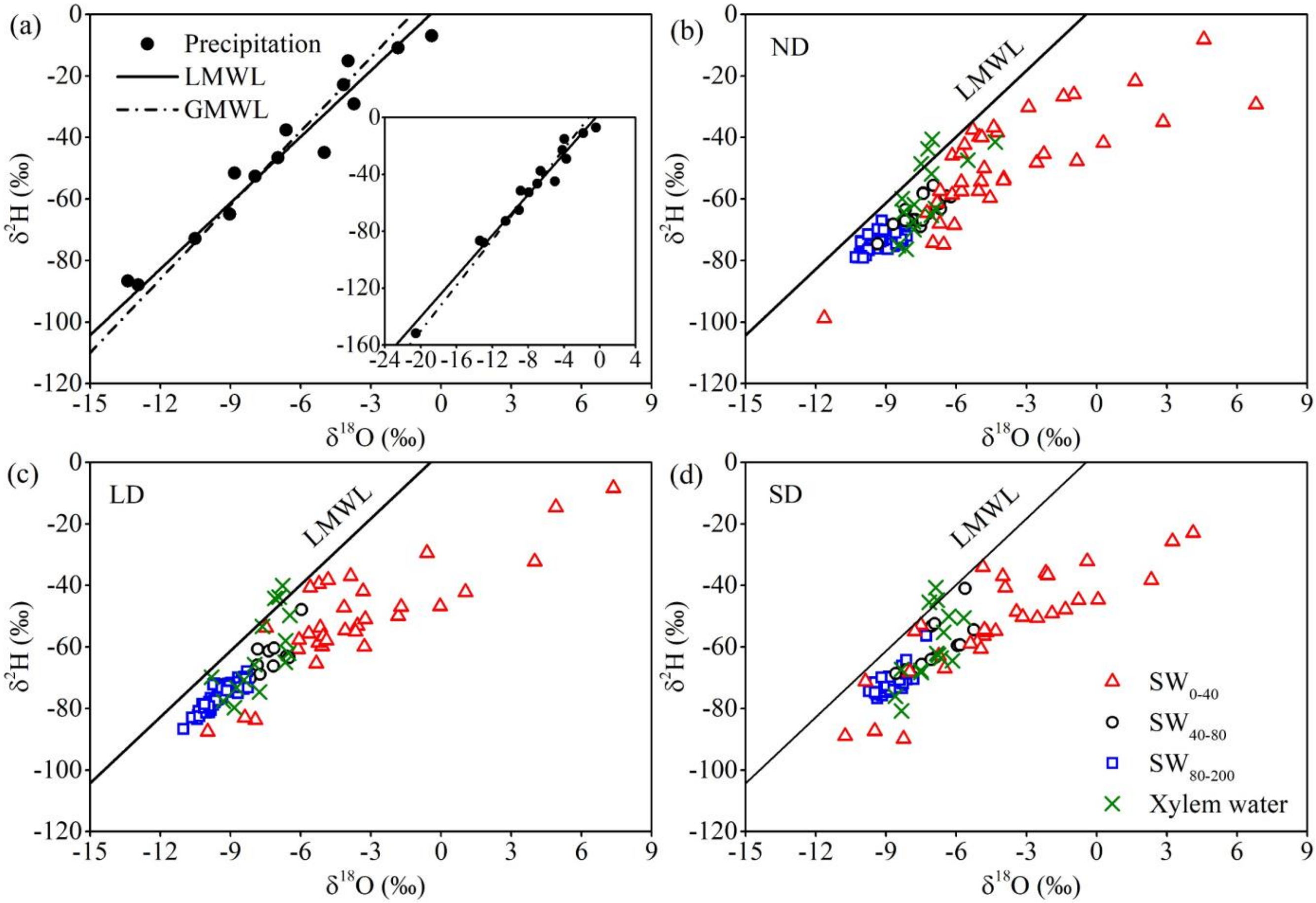

Figure 4: Relationships between δ^2H and δ^{18}O for precipitation, soil water, and xylem water. LMWL represents the local meteoric water line ($\delta^2H=7.17\delta^{18}O+3.19$, $R^2=0.97$), and GMWL represents the global meteoric water line ($\delta^2H=8\delta^{18}O+10$). $SW_{0–40}$, $SW_{40–80}$, and $SW_{80–200}$ represent the soil water in shallow (0–40 cm), middle (40–80 cm), and deep (80–200 cm) layers, respectively.

8. Line 304: Please replace ‘middle’ with the specific soil depth.

Reply

We agree with it and will replace ‘middle’ with the specific soil depth, as follows:

“*P. simonii in the ND and LD sites mainly absorbed shallow soil water in May (the month when the soil was the wettest), with contributions of 63.1% and 61.7%, respectively, while P. simonii in the SD site mainly absorbed middle soil water at the depth of 40–80 cm (48.0%) in May (Fig. 7a, b). P. simonii in the ND, LD, and SD sites mainly absorbed soil water at the depth of 40–80 cm from June to August, with contribution proportions of 42.1–45.0%, 38.3–45.2%, and 42.4–47.7%, respectively (Fig. 7a)*”.