We have carefully addressed all the comments made by Dr. Remy Schoppach and one anonymous reviewer on our manuscript (hess-2022-327) entitled "Quantifying river water contributions to riparian trees along a losing river: Lessons from stable isotopes and iteration method". The comments have helped us greatly improve the overall quality of the manuscript. The following is the point-point response to all the comments.

Response to Anonymous Referee #1:

General comments:

1. Comment:

This manuscript investigates the river water contribution to riparian trees. It does it by (1) determining and quantifying the sources of riparian trees water in soil and groundwater, (2) determining the sources of deep soil water and groundwater (precipitation, in-situ soil and groundwater, river water…) to finally (3) determine the proportion of river water that fed the riparian trees. This is an important work to better understand how riparian trees can affect stream flow and how we can better manage riparian zones in order to both protect rivers and riparian vegetation.

The manuscript is well-organized but I found the flow difficult to follow due to the grammar and wording mistakes throughout the manuscript (especially discussion section). The uncertainties of the MixSIAR model and iteration method are not really discussed, the MixSIAR model is also not well-enough presented in the method section. The discussion section is too light, I found that the discussion of the potential processes was too limited, as well as how do these results compare with other studies and why.

The figures are very good, there are just some grammar/wording mistakes in some captions.

Response: *Thank you for the positive comments and insightful suggestions. We have double-checked and revised the grammar and wording mistakes throughout the manuscript (including the figures). The iteration method and radon (^{222}Rn) concentration are supplemented in the Introduction section. We have added more information on the MixSIAR model to the M&M section (See the responses to Comments #14 and #15), and supplemented hydro-meteorological data (e.g., VPD, net radiation, relative humidity and temperature) to the Result section (Fig. S1). We substantially* *discussed the uncertainties of this model in the Discussion section. Especially for the major concerns, we have thoroughly revised the Discussion and discussed the potential processes. We have also compared our results with previous work and clearly explained the mechanisms.*

The Discussion has been revised from the following three aspects. Firstly, we added the strengths/weaknesses and implications of the MixSIAR model and the iteration method. Secondly, we discussed the potential processes of the RWC to transpiration flux of riparian trees, and further explained the effects of the distance from the stream as well as dry/wet year on RWC to transpiration flux of riparian trees. Finally, we discussed the link between RWC/WUE/WTD and its implications on management of rivers and riparian vegetation. The following is the revised Discussion section:

"4. Discussion

4.1 The strengths/weaknesses and implications of the MixSIAR model and the iteration method

Most previous studies considered river water as a direct water source for riparian trees, which may lead to large errors in estimating the RWC to transpiration flux of riparian trees. In comparison, the newly proposed iteration method and the MixSIAR model coupled with water stable isotopes are particularly useful for separating and quantifying the proportional contributions of indirect river water source to transpiration flux of riparian trees nearby a losing river. The primary advantage is that it explicitly identifies the direct and indirect water sources of riparian trees according to the distance from the riverbank, the extents of lateral roots, and the process of river recharging riparian deep water. Furthermore, the MixSIAR model has considered the uncertainties in isotope values and the estimates of source contributions compared with the simpler linear mixing models (Ma et al., 2016; Stock and Semmens, 2013). Both the trace plots and three diagnostic tests are used to check that the MixSAIR model has converged (Stock and Semmens, 2013). The strength of the multi-iteration method is that the total indirect RWC to transpiration flux of riparian trees nearby a losing river can be determined. The multi-iteration stops until there is no significant difference between the results of the last two iterations, which reduces the uncertainty of the calculated RWC to transpiration flux of riparian trees.

Although the MixSIAR model in combination with the iteration method were successfully used to quantify the indirect RWC to those riparian trees along a losing river; Nevertheless, it will not be available if the groundwater level is higher than river water level and groundwater feeds river (i.e., "gaining" river). Because the riparian trees along the gaining river mainly rely on the riparian deep water recharged by precipitation or upland infiltration via downhill flow rather than the lateral river water seepage (Miguez-Macho and Fan, 2021). Secondly, we assumed that the contributions of old river water (before initial time (t-1)) to riparian in-situ deep water were identical with those contributions of current river water (during the observation period between t-1 and t) to riparian in-situ deep water in this study. This might increase uncertainties on the estimations of the RWC to riparian deep water and RWC to riparian trees. Additional water samples need to be collected before the initial time to determine the contributions of old river water to riparian deep water.

4.2 The RWC to riparian trees and the effects of the distance from the stream on RWC

The deep-rooted riparian trees nearby a losing river were identified to use a small proportion of river water (less than 25%) for transpiration in this study (Fig. 10). It agreed well with previous work that the lateral roots of riparian trees further than 5 m away from the riverbank rarely took up river water when their outer projected edge of canopy (less than 5 m in our study) were out of reach of the river (Busch et al., 1992; Thorburn and Walker, 1994). Moreover, the ecohydrology separation reported in previous studies (Brooks et al., 2010; Evaristo et al., 2015; Allen et al., 2019; Sprenger et al., 2019) might result in considerable isotopic discrepancies between fast-moving water flow and immobile water for plant water uptake. The residence time of recharged groundwater from river water was extremely short (no more than 0.28 days) (Table 2). Only one third of the riparian groundwater was replaced by the infiltrating river water with an immobile groundwater proportion of 46.5% (Fig. 9). This probably indicated that the river water recharged mobile groundwater quickly but could not completely replace water held tightly in the soil pores (Brooks et al., 2010; Evaristo et al., 2015; Allen et al., 2019). It was consistent with Sprenger et al. (2019) who found that the lateral seepage of river water or rising water table could briefly saturate riparian soils but not entirely replace/flush immobile waters or isotopically homogenize different water pools. On the other hand, several recent studies showed that the tree species even phreatophytic/deep-rooted trees predominantly extended roots into fine pores to take up immobile soil water (Evaristo et al., 2015; Maxwell and Condon, 2016; Evaristo et al., 2019). As mentioned above, the immobile water could not be completely replaced by infiltrating river water, which eventually resulted in a small contribution of indirect river water to deep-rooted riparian trees.

However, our results are quite different from Alstad et al. (1999) who found that approximately 80% of the transpiration water of riparian Salix trees came from a losing river on the northeast side *of Rocky Mountain National Park, Colo. This is probably because that Alstad et al. (1999) only considered the river water and precipitation as potential water sources for riparian Salix. In fact, the river water seeps into the saturated/vadose zone across riparian riverbank and it is usually taken up by riparian trees in the form of river-recharged soil water/groundwater. In our study, we separated the contributions of indirect river water source (i.e., river-recharged deep soil water in the 80−170 cm layer and groundwater) for riparian trees. However, the RWC to riparian Salix trees calculated by Alstad et al. (1999) included all the proportional contributions of indirect river water, in-suit soil water as well as in-suit groundwater for riparian Salix trees.*

In this study, the RWC to riparian S. babylonica trees in wet 2021 was 1.4 times higher on average than in dry 2019 (Fig. 10). This is mainly because of the higher water table in wet year induced higher RWC to riparian deep water (including deep soil water in the 80−170 cm layer and groundwater) and consequently higher indirect RWC to riparian phreatophyte trees compared with dry year. Although there was no significant difference in the deep water (below the 80 cm layer) contributions to riparian trees between three plots, we observed the substantial effect of the declining water table with increasing distance from the riverbank on the reduced indirect RWC to riparian trees in dry 2019 (Fig. 10). Therefore, the temporal and spatial variabilities of the RWC to riparian S. babylonica trees were generally attributed to the various RWCs to riparian deep water rather than the water use patterns of riparian trees. Our result contrasts with the previous study by Qian et al. (2017) who reported a significant increase of the RWC to G. biloba trees in response to the water table decline. It was ascribed to that riparian G. biloba had a dimorphic root system and shifted their main water sources from shallow soil layer to deeper soil layer. Nevertheless, the potential root growth rate of riparian phreatophyte S. babylonica trees can reach 1-13 mm/day, which allows the riparian S. babylonica trees to remain in contact with a rising/declining water table and keep constant water uptake proportions from deep strata below the 80 cm depth in this study (Naumburg et al., 2005)."

4.3 The link between RWC/WUE/WTD and its implications

The water uptake patterns of riparian S. babylonica trees generally remained the characteristics of phreatophyte. We observed that the leaf WUE of all S. babylonica trees across three plots in both dry and wet years were negatively correlated with the indirect RWC to riparian trees and positively related to the WTD, respectively (Figs. 10, 11b, and 11c). These relationships are in consistent with previous studies (Behzad et al., 2022; Cao et al., 2020; Ding et al., 2020). Higher leaf WUE associated with lower RWC to riparian trees and lower groundwater levels are likely due to that the water stress restricts the stomatal conductance and further reduces transpiration rate of riparian trees. Specifically, dry 2019 was characterized as higher water demand (indicated by higher VPD) and lower water availability compared with wet 2021, but the energy resource (indicated by net radiation) for riparian trees was similar between two years (Figs. S1 and S2). We supposed that the water limitation rather than energy limitation regulated the leaf-level stomatal conductance of riparian S. babylonica trees. The high water demands but low river water availability in dry year probably resulted in stomatal closure of riparian trees to minimize the water loss, which could eventually lead to a decrease of transpiration rate and even photosynthetic rate (Behzad et al., 2022; Fabiani et al., 2021). Aguilos et al. (2018) further found that the water stress would enhance radiation-normalized WUE, because the lack of water availability induced a more reduction in transpiration than photosynthesis. On account of no difference in the average net radiation between dry and wet years, the lower river water availability in dry year probably resulted in an increase of the leaf WUE. It can be inferred that riparian S. babylonica trees took up more river water and probably showed a consumptive water use strategy in wet year compared to dry year. This agreed well with previous studies that the woody plants showed lower leaf WUE and consumptive water-use patterns in rainy season, while they showed higher leaf WUE and conservative water-use patterns with lower soil water availability in dry season (Behzad et al., 2022; Cao et al., 2020; Horton and Clark, 2001). However, the consumptive water use strategy of riparian trees could result in an overconsumption of the river water, which should be avoided in the riparian zone of a losing river.

It was evident that the WTD played a critical role in river water acquisition of riparian trees nearby losing rivers (Mensforth et al., 1994; Horton and Clark, 2001; Qian et al., 2017; Zhou et al., 2017). We observed that the declining water table linearly reduced the proportional contributions of river water sources for riparian trees, which consequently led to a proportional increase of leaf WUE (Fig. 11a). It was consistent with Horton and Clark (2001) who found an exponential growth function between the leaf WUE of riparian Salix gooddingii and WTD. As mentioned above, we emphasized the key role of reduced water availability to account for the decreasing transpiration rate' control on enhancing leaf WUE in this study. Nevertheless, there were *some controversial views that the leaf WUE firstly increased and then decreased with the increasing WTD (Antunes et al., 2018; Xia et al., 2018). This could be due to that riparian trees could tolerate declining water availability only up to a species-specific threshold, beyond which xylem cavitation and even crown mortality occurs (Naumburg et al., 2005). These indicated that the optimal WTDs for plant species were corresponding to the highest leaf WUE, under which plant species could consume lower transpiration water to maximize CO_2 assimilation. The break point of WTD was not observed in this study, suggesting that further investigations should be conducted under deeper water tables (> 4 m) to quantify the optimal WTD and further optimize the riparian plant-water relations.*

Our results have important implications for untangling the trade-off relationships between riparian tree water use and river runoff management. Considering various water and energy resources as well as the leaf WUE of riparian trees, the relative amount of RWC to riparian trees has been compared between dry and wet year to investigate the effects of river water availability on physiological characteristics of riparian trees. The riparian S. babylonica trees likely remained the highest WUE (i.e., utilize lower transpiration water to maximize CO_2 assimilation) as well as the lowest river water uptake proportion under the lowest water table condition (with the WTD of 4 m). In this study, the lower the groundwater level is, the more beneficial it is to optimize the riparian plant-water relations. Therefore, the relationships between the RWC to riparian trees, leaf-level physiological characteristics (e.g., leaf WUE) and hydro-meteorological conditions are critical and helpful for the better protection of the riparian forest while maintaining sustainable river runoff.”

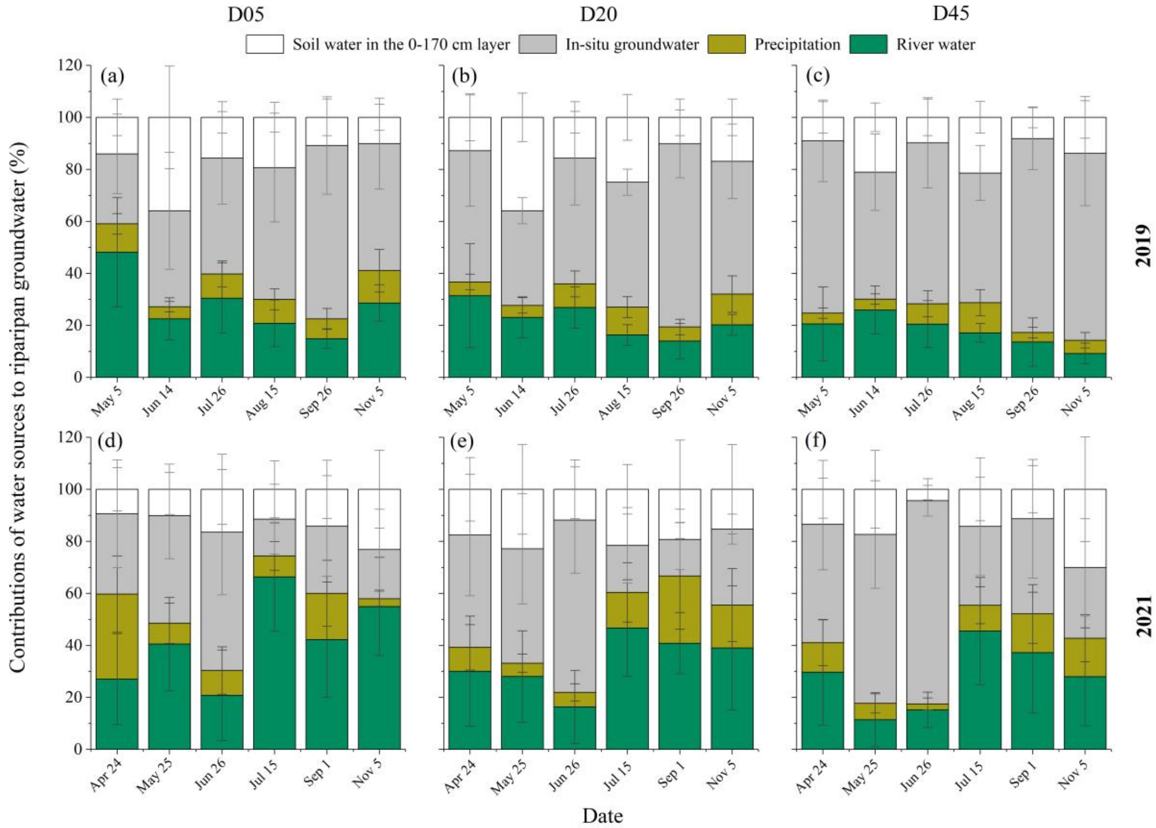

Figure 9: Seasonal variations in the different water source contributions to riparian groundwater in the three plots (D05, D20, and D45) for observation years 2019 (a−c) and 2021 (d−f). D05, D20, and D45 are the plots at distance of 5 m, 20 m, and 45 m away from the riverbank, respectively. The error bars indicate standard deviations.

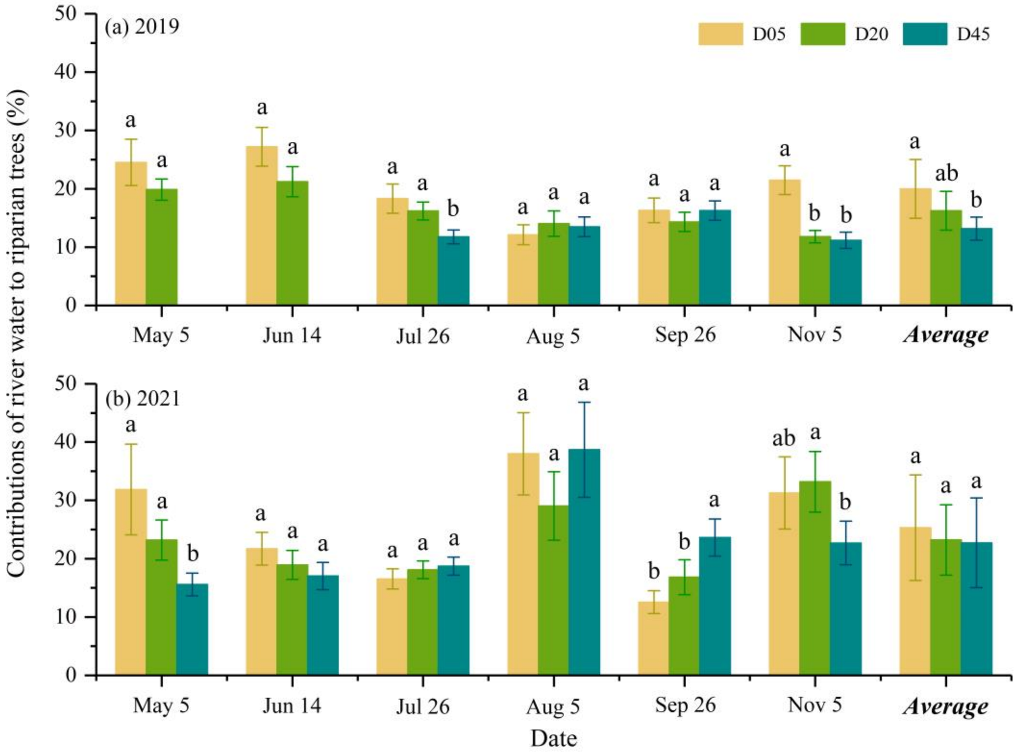

Figure 10: River water contributions (RWCs) to riparian trees in the three plots (D05, D20, and D45) for each sampling campaign during the observation period in 2019 (a) and 2021 (b). Different letters show a significant difference in the RWC to riparian trees between three plots ($p < 0.05$). D05, D20, and D45 are the plots at distance of 5 m, 20 m, and 45 m away from the riverbank, respectively.

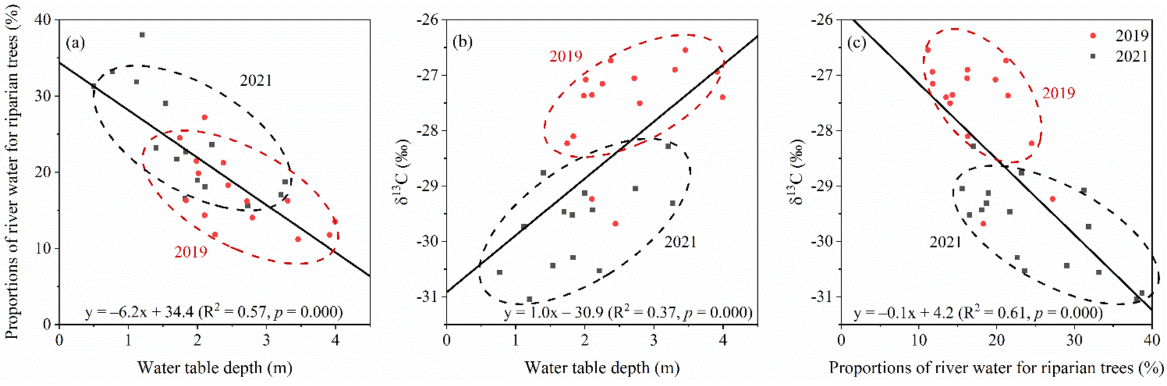

Figure 11: Relationships between river water contributions to riparian S. babylonica and the water table depth (a), between leaf $\delta^{13}C$ values and the water table depth (b), and between leaf $\delta^{13}C$ values and river water contributions to riparian S. babylonica (c).

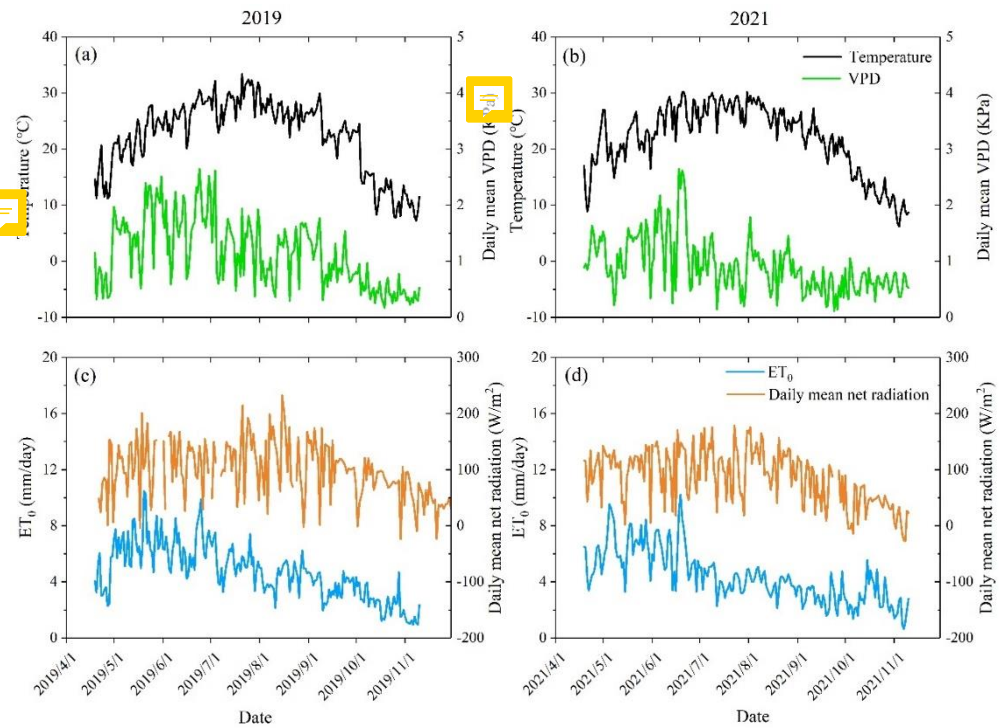

Figure S1. Daily mean temperature (℃) and daily mean vapor pressure deficit (VPD, kPa) during the observation period in 2019 (c) and 2021 ([illegible]). Daily reference evapotranspiration (ET_0, mm/day) and daily mean net radiation (W/m^2) during the observation period in 2019 (c) and 2021 (c).

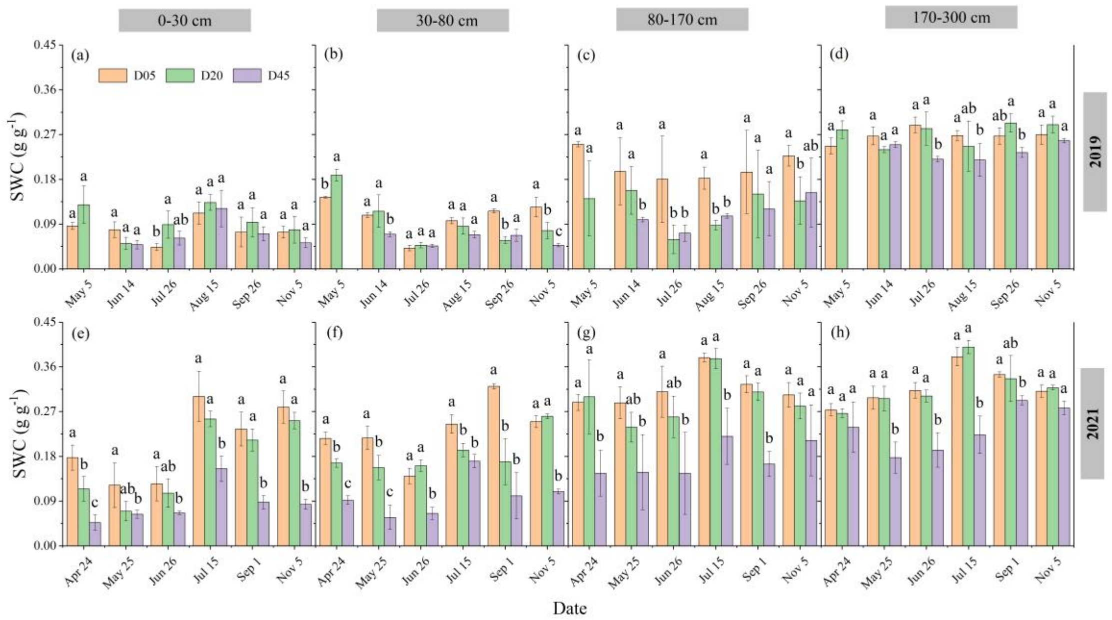

Figure S2: Seasonal variations of soil water content (SWC) in the 0−30 cm, 30−80 cm, 80−170 cm, and 170−300 cm layers on twelve campaigns (a−h) for the observation years 2019 (a−d) and 2021 (e−h). Different letters (a, b, and c) show a significant difference in the SWC between three plots ($p < 0.05$). D05, D20, and D45 are the plots at distance of 5 m, 20 m, and 45 m away from the riverbank, respectively.

Specific comments:

INTRODUCTION

2. Comment:

Line 41: I feel that the jump to paragraph 2 (contribution of river water to riparian trees) is too quick, maybe have a small paragraph beforehand presenting the different sources of water for riparian trees (groundwater, soil water, river water?) first?

Response: *We have added a sentence "The potential water sources of riparian trees along a losing river are typically considered as a mix of soil water at different depths, groundwater, and river water (Alstad et al., 1999; White and Smith, 2020)." at the beginning of the second paragraph. Then it shifts to introduce the debate on whether river water is a potential water source for riparian trees or not and how it becomes available to plants.*

3. Comment:

Line 41: Can you be more specific about "data comparison"? It is unclear.

Response: *The "data comparison" has been specified as the direct comparison of stable isotope values between stem water and different source waters. This method is similar to the "graphical inference" method, which could determine the possible root water uptake depth when the stem water isotope is same as the isotopic value of soil water at a certain depth. However, both the "data comparison" and "graphical inference" methods cannot quantify the proportional contribution of different water sources to plants. We have deleted the words "data comparison" and "graphical inference", and changed this sentence to "The statistical two- or multi-source linear mixing models (Ehleringer and Dawson, 1992; Alstad et al., 1999) and Bayesian mixing models (MixSIR, SIAR, SISUS, MixSIAR) (Ma et al., 2016; Wang et al., 2019b; White and Smith, 2020; Li et al., 2021) accompanied with stable water isotopes (δ^2H and $\delta^{18}O$) have been widely used to estimate the RWC to riparian trees.".*

M&M

4. Comment:

Lines 112-125: I think you should develop on the storage in the field and until you put the samples in the fridge (where/in what did you stored the samples? what method did you use to limit evaporation for the water samples?), this is important and not really described in this section. Also, use the (full) technical name of the tools you used in the field for sampling (e.g., “hydrophore”?) or storage of samples (e.g., “brown bottle” is unclear).

Response: *Thanks for your professional suggestions. We have added description of the field storage procedure. All the samples (river water, groundwater, soil samples, plant stem samples, plant leaf samples and precipitation) were put into the refrigerating box with several ice bags to avoid evaporation effects in the field. And all the samples were delivered to the laboratory and stored at 4℃/-10℃ in the refrigerator. We have provided the full technical names of the tools used in the field for sampling or storage of samples. For example, we have changed “hydrophore” to “Perspex hydrophore water sample collector with capacity of 1L”. The “brown bottle” has been changed to “100-ml brown glass vial”.*

5. Comment:

Line 115: I am not sure what is it, maybe be more specific and use the full technical name? Maybe “plexiglass hydrophore water sample collector”? But I am not sure about what you used.

Response: *We have changed the “hydrophore” to a more specific technical name “plexiglass hydrophore water sample collector with capacity of 1L”.*

6. Comment:

Line 115: Why 135 precipitation samples? Before you said precipitation was sampled during the 12 campaigns, I would clarify this point. Also, what was the frequency of sampling? And the location?

Response: *We apologize for the oversight. In fact, precipitation was sampled after each precipitation event and not merely collected during the 12 campaigns. A total of 135 precipitation samples were collected throughout the whole years of 2019 and 2021 in order to get the local meteoric water line (LMWL) in the dual-isotope plot. We have changed this sentence to “Precipitation was sampled after each precipitation event via a device consisting of a funnel, a polyethylene bottle and a ping-pong ball. And a total of 135 precipitation samples were collected* *throughout the whole years of 2019 and 2021."*

7. Comment:

Lines 120-121: So 3 trees for each plot?

Response: *One tree was sampled for each plot. We have changed this sentence to "One riparian S. babylonica tree was chosen in each plot for* δ^2H *and* $\delta^{18}O$ *measurements in xylem water as well as* $\delta^{13}C$ *analysis in plant leaves. The mean diameter at breast height of three sampled trees was 28.6 ± 4.4 cm."*

8. Comment:

Line 122: What do you mean by "several"? Was is not 3/plot? Did you take several samples in the same tree? I would use "sampled" rather than "cut". How did you sampled the stem? What tool did you use? Also, correct to "[…], we removed the bark.".

Response: *"Several stems" means that five mature and suberized stems were taken from the same tree in each plot. We have changed "cut" to "sampled". An averruncator with the length of 5 m was used to sample the stem. We have changed the confusing sentence "Several suberized stems were firstly cut from riparian S. babylonica, removed the bark and phloem, and then stored at −10 ℃ until water isotope analysis." to "Five mature and suberized stem samples were taken from the same riparian S. babylonica tree in each plot using an averruncator with the length of 5 m. We removed the bark and phloem of the sampled stems, and then put the remaining xylem samples into a 12-ml brown glass vial sealed with the parafilm."*

9. Comment:

Line 123: Maybe specify: "stored the remaining xylem at.."? Where/in what did you store it? Glass vial?

Response: *We have changed this sentence to "We removed the bark and phloem of the sampled stems, and then put the remaining xylem samples into a 12-ml brown glass vial sealed with the parafilm. The remaining xylem samples were stored in a refrigerating box with several ice bags in the field. Then the xylem samples were transported to the laboratory and kept in a refrigerator at −10 ℃ before water extraction and isotope analysis."*

10. Comment:

Line 124: In what did you stored the leaves before drying them?

Response: *The mature leaf samples were stored in a refrigerating box with several ice bags in the field until they were transported to the laboratory. The mature leaves were oven-dried at 65 °C for 72 h on the day of sampling to avoid the effects of microorganisms.*

11. Comment:

Lines 126-130: This is a great section with the details needed (sampling method, storage). Can you clarify: you sampled soil only at 1 location for each plot, right? I would add a reference for the oven-dry method.

Response: *Yes, we collected the soil sample only at one location for each plot. We have clarified that "Soils at depths of 0−5, 5−10, 10−20, 20−30, 40−60, 60−80, 90−110, 150−170, 190−210, 250−270, and 280−300 cm in one soil profile nearby the selected S. babylonica trees were sampled by a power auger (CHPD78, Christie Engineering Company, Sydney, Australia)." We have added two references for the oven-dry method as follows "One part of each soil sample was put into a 12-ml brown glass vial and stored at −10 °C before water stable isotope analysis, and the other part was packed into an aluminum box for gravimetric soil water content (SWC) measurement via the oven-drying method (Li et al., 2021; Wang et al., 2019b)."*

References:

Li, Y., Ma, Y., Song, X. F., Wang, L. X., and Han, D. M.: A δ^2H offset correction method for quantifying root water uptake of riparian trees. Journal of Hydrology. 593, 125811, doi:10.1016/j.jhydrol.2020.125811, 2021.

Wang, J., Fu, B., Lu, N., Wang, S., and Zhang, L.: Water use characteristics of native and exotic shrub species in the semi-arid Loess Plateau using an isotope technique. Agriculture, Ecosystems & Environment. 276, 55-63, 2019b.

12. Comment:

Line 150: Do you have a reference to support this choice for k?

Response: *We have added the supporting reference for the parameter "k" (Clever, 1985).*

The diffusion coefficient 'k' indicates the ^{222}Rn concentration relationship between a watery phase and the air volume existing above. This relation is dependent on the temperature. With falling temperatures, the quantity of radon soluble in water increases. For example, the diffusion coefficient 'k' increases when temperature drops. The dependency for temperature of the diffusion coefficient for the transition of the phase water/air is presented in Fig. A1.

The influence of the radon diffusion coefficient 'k' is low in the temperature range between 10° C and 30° C. A diffusion coefficient k of 0.26 can be applied within the specified temperature range for a typical room temperature of 20° C (Fig. A1).

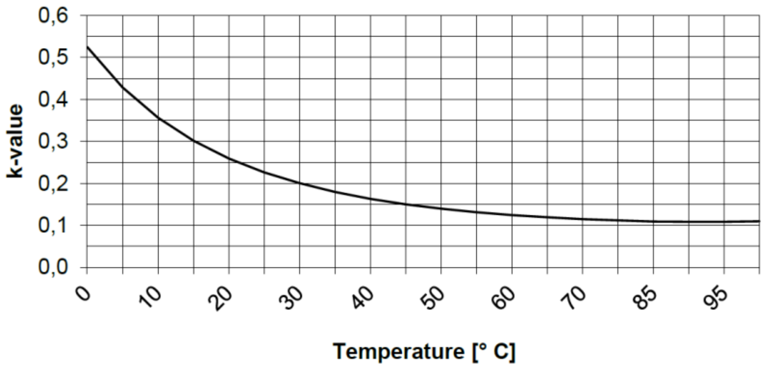

Figure A1. Temperature dependency of the diffusion coefficient 'k' (Clever, 1985)

References:

Clever, H. L.: Solubility Data Series. Vol.2, Krypton-, Xenon, Radon Gas Solubilities, p. 463-468, Pergamon Press, Oxford, 1985.

13. Comment:

Lines 168-169: So you calculated the average isotopes values for each of the four layers? You measured soil water isotopes at 11 depths.

Response: *In this study, we measured soil water isotopes at 11 depths in the three plots. In order to reduce errors in the analytical procedure, four soil layers (0−30, 30−80, 80−170, and 170−300 cm) were divided according to the seasonal variations in SWC, water isotopes and WTD to identify the main root water uptake depth of riparian trees. The average and standard deviation (SD) isotopes values for each of the four layers (source data) were input to the MixSIAR model.*

14. Comment:

Line 175: I don't understand "set as the mixture data", please clarify. Maybe more info on the MixSIAR model would help, I find it a bit frustrating for the reader to have to look in other papers. It would also help to understand why you talk about sampling times later in the text (lines 184-188, for example). Maybe have a separate section just to present the model (before 2.4.1.)?

Response: *We have added more detailed information on the MixSIAR model before section 2.4.1 "MixSIAR model is a Bayesian mixing model which could apply stable isotope data to quantify the proportions of source contributions to a mixture (Stock and Semmens, 2013). The input data of the MixSIAR model include mixture data, source data, and discrimination data. In this study, the mean and standard deviation (SD) of isotopic values for each of the riparian tree water sources were input as source data into the MixSIAR model, while the raw mixture data (the measured isotopic values for stem water) were directly input into the MixSIAR model. The discrimination data for both* δ^2H *and* $\delta^{18}O$ *were set as zero, because the input* δ^2H *and* $\delta^{18}O$ *values in the MixSIAR were non-fractionated or* δ^2H*-corrected (See the 2.4.1 and 2.4.2 sections). The Markov Chain Monte Carlo parameter was set to "very long" run length to ensure the highest accuracy. We used both the trace plots and three diagnostic tests (i.e., Gelman–Rubin, Heidelberger–Welch, and Geweke) to decide whether the MixSIAR model has converged or not (Stock and Semmens, 2013). The mean and SD of the different source contributions (median values) to each mixture were finally estimated in the MixSIAR model."*

15. Comment:

Lines 185 and 187: So when you say "soil water in 0-80 cm" and "soil water in 0-170 cm": does the model takes the layer as a whole or does it still account for the different soil layers 0-30, 30-80, 80-170 cm? And how do you integrate the soil water isotopes measured at 11 soil depths in the model? I think more information about that is needed in the manuscript (especially for the readers - like me - who are not familiar with the model).

Response: *When we state "soil water in 0-80 cm" and "soil water in 0-170 cm", it still accounts for the different soil layers in 0-30 cm, 30-80 cm, and 80-170 cm in the MixSIAR model. The proportional contributions of soil water in the 0-30 cm, 30-80 cm, and 80-170 cm layer for riparian deep water were separately estimated in the MixSIAR model. We finally add up the proportional* *contributions of different soil layers.*

More information for integrating the soil water isotopes measured at 11 soil depths in the model has been added as follows: "The average soil water isotopes values at depths of 0−5, 5−10, 10−20, and 20−30 cm were calculated for the 0-30 cm soil layer, because water isotopes went through strong evaporation and the SWC varied significantly seasonally. The soil water isotope values at depths of 40−60 and 60−80 cm were averaged for the 30-80 cm soil layer, and those values at 90−110 and 150−170 cm depths were averaged for the 80−170 cm soil layer as the water isotopes and SWC were relatively stable. The average isotopes values of soil water at deep depths (190−210, 250−270, and 280−300 cm) were calculated for the 170-300 cm soil layer, which varied with the fluctuations of water tables."

16. Comment:

Line 194: Can you provide a reference for the decay coefficient?

Response: *We have added a reference for the decay coefficient as "where λ represents the decay coefficient (0.181 day^{-1}) (Hoehn and Von Gunten, 1989)."*

Reference:

Hoehn, E. and Von Gunten, H. R.: Radon in groundwater: A tool to assess infiltration from surface waters to aquifers. Water Resources Research. 25(8), 1795-1803, 1989.

17. Comment:

Line 195: How was this value determined?

Response: *We have added more information about the determination of C_e. The C_e represents the ^{222}Rn concentration of background groundwater when the equilibrium between radon production and decay is reached. The measuring ^{222}Rn concentration of groundwater in aquifers more than 100 m away from the riverbank remains constant in this study (with an average value of 7400.0 ± 35.4 Bq/m^3), suggesting that C_e can be defined as 7400.0 Bq/m^3.*

18. Comment:

Lines 205-222: It is an important method here but I found this part difficult to follow. There are A LOT of symbols, maybe use a table instead of the 7 lines of text so it's more readable? I also did not remember what was Ps and Pg, I would explain these terms here again. I would suggest to change some of the terms, or try to include the time as subscript (t-1, t) so it's easier to follow.

Response: *This is a good comment. We have simplified this equation to make it more readable. The Eq (4) has been changed to:*

"$RWC = P_s * S_r + P_g * G_r$

$= P_s*(s_r^t + s_r^{t-1}) + P_g*(g_r^t + g_r^{t-1})$

$= P_s*(s_r^t + s_r^t*s_s^{t-1} + s_r^t*(s_s^{t-1})^2 + s_g^t*g_r^t + s_g*g_r^t*g_g^{t-1} + s_g^t*g_r^t*(g_g^{t-1})^2) + P_g*(g_r^t + g_r^t*g_g^{t-1} + g_r^t*(g_g^{t-1})^2)$

$= (P_s*s_r^t + P_g*g_r^t + P_s*s_g^t*g_r^t) + (P_s*s_r^t*s_s^{t-1} + P_g*g_r^t*g_g^{t-1} + P_s*g_r^t*s_g^t*g_g^{t-1}) + (P_s*s_r^t*(s_s^{t-1})^2 + P_g*g_r^t*(g_g^{t-1})^2 +$
$P_s*s_g^t*g_r^t*(g_g^{t-1})^2)$ (4)"

In order to make the text clearer, we added a supplement Table S1 to display the abbreviations of all the variables (See Table S1). In addition, we have explained the P_s and P_g terms here again. And we modified the terms that has been used to represent time information as subscript (t-1, t) to make them clearer.

Table S1 Acronym dictionary

RWC	*River water contribution*
WUE	*Leaf-level water use efficiency*
WTD	*Water table depth*
T	*Temperature*
RH	*Relative air humidity*
ET_0	*Reference evapotranspiration*
VPD	*Vapour pressure deficit*
SWC	*Soil water content*
IRIS	*Isotopic ratio infrared spectroscopy system*
IRMS	*Isotope Ratio Mass Spectrometry system*
VSMOW	*Vienna Standard Mean Ocean Water*
C_{Water}	^{222}Rn *concentration of the water samples*
C_{Air}	*Air* ^{222}Rn *concentration of the water samples*
C_{System}	*Air* ^{222}Rn *concentration values of the measurement system*
V_{System}	*The interior volume of the measuring set-up*

V_{Sample}	The volume of water sample
T_{res}	The average residence time of recharged groundwater from river water
k	The ^{222}Rn distribution coefficient of water/air
λ	The decay coefficient
C_e	The ^{222}Rn concentration of background groundwater when the equilibrium between radon production and decay is reached
C_r	The ^{222}Rn concentration of river water
C_g	The ^{222}Rn concentration of riparian groundwater
PWL	The potential water source line
a_p	The slope of the PWL
b_p	The intercept of the PWL
PW_{excess}	The δ^2H deviation of riparian tree xylem water from the PWL
S_r	The total (during the entire period of river losing since 2007) RWCs to riparian deep soil water in the 80−170 cm layer
G_r	The total (during the entire period of river losing since 2007) RWCs to riparian groundwater
P_s	The contributions of riparian deep soil water in the 80−170 cm layer to riparian trees
P_g	The contributions of riparian groundwater to riparian trees
s_r^{t-1}	The proportional contributions of the old river water (before t-1) to riparian deep soil water in the 80−170 cm layer
g_r^{t-1}	The proportional contributions of the old river water (before t-1) to riparian groundwater
s_s^{t-1}	The proportional contributions of in-situ soil water in the 80−170 cm layer at t-1 for riparian deep soil water in the 80−170 cm layer at t
s_r^t	The proportional contributions of river water during t-1 to t for riparian deep soil water in the 80−170 cm layer at t
s_g^t	The proportional contributions of groundwater during

	t-1 to t for riparian deep soil water in the 80−170 cm layer at t
g_g^{t-1}	*The proportional contributions of in-situ groundwater at t-1 for riparian groundwater at t*
g_r^t	*The proportional contributions of river water from t-1 to t for riparian groundwater at t*
ANOVA	*One-way analysis of variance*
LMWL	*Local meteoric water line*

RESULTS

19. Comment:

Lines 234-235: I think the slope of the LMWL only gives an indication about how oxygen and deuterium co-evolve, it does not indicate if the value is high or low. You can have 2 measurements of lower isotopes values but still have the same slope as with 2 measurements of higher isotopes values.

Response: *The slope of the LMWL indeed mainly gives an indication of the evaporation degree of water samples. We have changed this sentence to "The slope of the local meteoric water line (LMWL) in 2021 (7.8) was significantly higher compared to 2019 (5.5) ($p < 0.05$), which suggested that the falling raindrops undergone stronger sub-cloud evaporation in 2019 (Zhao et al., 2019).".*

Reference:

Zhao, L., Liu, X., Wang, N., Kong, Y., Song, Y., He, Z., Liu, Q. and Wang, L.: Contribution of recycled moisture to local precipitation in the inland Heihe River Basin. Agricultural and Forest Meteorology. 271, pp.316-335, 2019.

20. Comment:

Line 276: How did you get a negative residence time? Would it make more sense to use "0"?

Response: *It will make more sense to use "0" instead of a negative residence time, due to the fact that the river water recharges groundwater frequently in this study. We have changed all the negative residence time values to "0" throughout the text and in Table 2. The confusing sentence "As shown* *in Table 2, there was a significant increase of ^{222}Rn activities in groundwater from D05 (494.5 ± 107.5 Bq/m^3) to D45 (787.4 ± 153.2 Bq/m^3) ($p < 0.05$). The T_{res} of groundwater that recharged by river to the underlying aquifer and/or riverbank increased from D05 (−0.09 ± 0.09 days) to D45 (0.15 ± 0.13 days) (Table 2)." has been changed to "There was a significant increase of ^{222}Rn activity in groundwater from D05 (610.1 ± 107.5 Bq/m^3) to D45 (787.4 ± 153.2 Bq/m^3) ($p < 0.05$) (Table 2). The T_{res} of recharged groundwater from river water increased from D05 (0 days) to D45 (0.15 ± 0.13 days) (Table 2)."*

Table 2: The ^{222}Rn values in river water, background groundwater and riparian groundwater in three plots (D05, D20, and D45), and the average residence time of recharged groundwater from river water (T_{res}, day) in 2021. The background groundwater represents groundwater in aquifers more than 100 m away from the riverbank.

	River water	Background groundwater	Riparian groundwater		
			D05	D20	D45
^{222}Rn value (Bq/m^3)	610.1 ± 212.3	7400.0 ± 35.4	610.1 ± 107.5	763.3 ± 118.3	787.4 ± 153.2
T_{res} (days)	0	Null	0	0.13 ± 0.1	0.15 ± 0.13

Notes: D05, D20, and D45 are the plots at distance of 5 m, 20 m, and 45 m away from the riverbank, respectively.

21. Comment:

Lines 280-291: I would also remove the first sentence here and go straight to the results. I find the first paragraph difficult to follow because you present a mix of interannual and seasonal differences, think about what you want to present. You could have a first paragraph presenting the interannual differences, a second presenting the seasonal differences (differences between months for a SAME year). From my point of view, the Figure 9 only shows the differences between plots (you only show the stats for this), not between years (despite the same scales for the y axes) and months, so I would only refer to Figure 9 in the second paragraph.

Response: *We have removed the first sentence and went straight to the results. We have a first paragraph presenting the interannual differences, and a second presenting the seasonal differences (differences between months for a SAME year). We have only referred to Figure 9 in the third paragraph.*

The first paragraph has been changed to "The proportional contributions of river water to riparian S. babylonica trees were significantly higher in 2021 (mean of 23.8% ± 7.8%) than in 2019 *(mean of 16.8% ± 4.7%) ($p < 0.05$). Specifically, the most significantly monthly difference in the RWC to riparian S. babylonica trees between dry 2019 and wet 2021 was up to 19.8% ($p < 0.001$). The monthly maximum value of the RWC to S. babylonica trees was significantly higher in wet 2021 (35.2% ± 7.0%) compared with dry 2019 (24.2% ± 3.0%) ($p < 0.05$)."*

The second paragraph has been added to present the seasonal differences in RWCs to riparian trees for a SAME year: "The riparian S. babylonica took up the most river water in July (35.2 ± 7.0%) and November (29.0 ± 5.0%) in 2021, whereas the highest RWCs to riparian trees occurred in May (22.2 ± 1.7%) and June (24.2 ± 1.6%) in 2019. The minimum river water uptake for S. babylonica in 2021 was 17.7 ± 2.7% (in September), while riparian trees took up the least water in August 2019 (13.2 ± 1.9%). No significant seasonal-trend of RWCs to riparian trees was observed in both years ($p > 0.05$)."

22. Comment:

Lines 288-291: This section reads well but you say in the first sentence that there are significant differences in RWC between the 3 plots in 2021 while there is no difference (Fig 9), please correct.

Response: *We have corrected the first sentence as follows: "The water uptake of river water by riparian S. babylonica was significantly different between the three plots in 2019 ($p < 0.05$), while no difference was observed between the three plots in 2021 ($p > 0.05$) (Fig. 10)."*

23. Comment:

Lines 299-304: I would add in the text the R2 and p values of the linear models even if they are shown in Figure 10. Why did you fit the model to the whole dataset? And not one model for each year? It should be explained in the data analysis section, maybe I missed this point.

Response: *We added the R^2 and p values of the linear models in the text as follows: "There was a significant negative relationship between the RWC to riparian trees and the WTD ($R^2 = 0.57$; $p = 0.000$) (Fig. 11a). The leaf $\delta^{13}C$ of riparian S. babylonica was found to be negatively correlated with the RWCs to S. babylonica ($R^2 = 0.61$; $p = 0.000$) but positively related to the WTD ($R^2 = 0.37$; $p = 0.000$) in linear functions (Fig. 11b and c)."*

We also added the reasons for fitting the model to the whole dataset in the "2.5 data analysis" section. "In order to get the general relationships (not only available for 2019 dry year but also for

2021 wet year) between the WTD, leaf $\delta^{13}C$ values and RWCs to riparian trees, the linear regression model using for quantifying their relationships was fitted to the whole dataset in both two years."

DISCUSSION

24. Comment:

I think that this section is not well-enough developed and that the sections should be revised in order to reflect the objectives presented in the introduction. There is also no discussion about the MixSIAR model and the iteration method presented here and on which all the results are based. I would add a section to discuss about their strengths/weaknesses and implications for the discussed results. Then, I would discuss the RWC to riparian trees and the effect of the distance from the stream. Finally, I would discuss about the link between RWC/WUE/WTD and its implications (also include management). I think the discussion about the potential processes and implications should be developed, also how do your results compare with previous work and why?

Response: *This is a good comment. We have reorganized the entire discussion section. Firstly, we discussed the strengths/weaknesses and implications of the MixSIAR model and the iteration method. Secondly, we discussed the RWC to riparian trees and the effects of the distance from the stream and dry/wet year on RWCs to riparian trees. In this section, we discussed and developed the potential processes. Finally, we discussed the link between RWC/WUE/WTD and its implications on management of riparian forest and river runoff. We have compared the results with previous work and provided corresponding explanations throughout the revised discussion section. The entirely revised discussion was displayed in the response to comment #1.*

25. Comment:

Lines 336-342: You just look to mostly report previous findings here. First, what YOUR results suggest? Then, HOW does it relates/compare to previous work?

Response: *We have revised these sentences to emphasize the implications of our results and compare our results with previous work. The revised part can be found in the first paragraph of the 4.2 discussion section in the response to comment #1.*

26. Comment:

Lines 344-345: This point is super interesting; can you try to make the story about this clearer?

Response: *We have clarified this point in detail. The revised story has been specified in the response to the comment #1 (The first paragraph of the 4.2 discussion section).*

27. Comment:

Lines 381-382: I don't think you can really compare your "optimal" WTD with values from other studies because it is not the same site. I would rather discuss the potential reasons of these differences. Clarify the "knee point", I see what you mean but I would reword, a "break point" instead?

Response: *We have compared our "optimal" WTD with values from other studies and extensively discussed the potential reasons of these differences. The reorganized discussion part has been specified in the response to the comment #1 (The second paragraph of the 4.3 discussion section)*

In addition, we changed the "knee point" to "break point".

28. Comment:

Line 390: You talk about accurate separation and quantification of RWC to riparian trees but we don't know the limitations and uncertainty of the model and iteration method.

Response: *We have added the discussion about the advantages, limitations and uncertainties of the model and iteration method in the section 4.1 ("The strengths/weaknesses and implications of the MixSIAR model and the iteration method"). The reorganized discussion section has been specified in the response to the comment #1.*

CONCLUSION

29. Comment:

1. Lines 401-408: I think this is too much results, the conclusion should not be like an abstract. I would focus more on the implications of your findings for riparian zones management and future research.

Response: *We have modified the conclusion part and focused more on the implications of our* *findings for riparian zone management and future research. The revised conclusion part is as follows:*

"In this study, we presented a new iteration method together with stable water isotopes (δ^2H and $\delta^{18}O$) and the MixSIAR model to separate and quantify the indirect RWC to riparian S. babylonica in dry 2019 and wet 2021 along a losing river in Beijing, China. It was found that the infiltrating river water quickly exchanged with riparian mobile water but not mixing with waters held tightly in the fine pores. Riparian trees nearby a losing river generally extended roots into fine pores to access immobile water sources. The isotopic discrepancies between fast-moving water flow and immobile water for plant water uptake led to a small RWC (20.3%) to riparian trees. The water deficit in dry year could induce stomatal closure and larger reduction in transpiration of riparian trees, leading to an evident increase of WUE compared with that in wet year. The leaf WUE showed a negatively correlation with the RWCs to riparian trees but was positively related to the WTD in linear functions ($p < 0.001$). These suggested that rising water table would trigger riparian trees to increase river water acquisitions and show a consumptive water use strategy, which would not be recommended for the water resources management of a losing river. The maximum WTD of 4 m seemed to be optimal for protecting both the river runoff and riparian revegetation, maintaining highest water use efficiency, and minimizing the plant transpiration. This study provides valuable insights into riparian afforestation related to water use and healthy riparian ecosystem enhancement."

<u>Technical corrections:</u>

<u>INTRODUCTION</u>

30. <u>Comment:</u>

Line 34: English is not my mother tongue but should it be "replenishment" instead of"replenishing"?

Response: *We have changed " replenishing" to "replenishment".*

31. <u>Comment:</u>

Lines 38-40: This is a very interesting question but some parts of the sentence need to be edited to have a clearer sentence. By "where" I guess you mean the sources? At the first read I thought you were talking about where along the river, I would use “source” to be clearer. I would change “responses to the variations in the water table” to “response to water table variations”. Also, be more precise about what you are talking about: is it the river water or groundwater level? When you say “revegetated riparian species” it means that the species are revegetated, which is false, I would change to “tree water requirement of revegetated riparian zones/areas” for exemple (it is the riparian zone/area that have been revegetated). Finally, I am not sure that the word “balance” is the best one to use here, I would improve the wording of the sentence.

Response: *We have modified the “where and how much water riparian tree take up” to “what water sources and how much river water is used by riparian trees”. In addition, we have changed “responses to variations in the water table” to “responses of plant water use characteristics to groundwater level variations”. The “revegetated riparian species” has been changed to “revegetated riparian zones”. We have deleted the word “balance” and improved the wording of this sentence as follows: “Therefore, understanding what water sources and how much river water are used by riparian trees as well as the responses of plant water use characteristics to groundwater level variations can help to control the river runoff and tree water requirement of revegetated riparian zones.”*

32. Comment:

Line 47: Can you be more specific about the “different waters”? Different “water sources”?

Response: *We have specified the “different waters” as “different water sources and plant stem water”*

33. Comment:

Line 51: Do you mean “change in river water level”?

Response: *Yes. We have changed “changes in river water” to “the changes in river water level”*

34. Comment:

Lines 62-66: I would improve the wording of the sentences. From my point of view, it does not read that well while it is important to state clearly the knowledge gap/issue here. Also, “estimations” of what?

Response: *We have rewritten these sentences and clarified the knowledge gap as follows: "There is growing evidence indicating that riparian trees at a certain distance away from the riverbank rarely took up river water directly, because their lateral roots could not reach the river (Mensforth et al., 1994; Thorburn and Walker, 1994). Nevertheless, riparian trees could indirectly utilize the river water seeped into riparian deep zone (including deep soil water and groundwater) when their roots tapped into the groundwater level (Mensforth et al., 1994; Wang et al., 2019b). Treating river water as a direct water source might lead to inaccurate estimations of the RWC to transpiration flux. However, it remains unclear that how to separate and quantify the contribution of the indirect river water source that recharges riparian deep water to transpiration flux of riparian trees nearby losing rivers."*

35. Comment:

Lines 67-81: Maybe I'm too picky but be more specific when you use WUE: is it WUE of plant (lines 69, 70)? Trees (lines 73, 79)? Similarly for RWC, I would specify "RWC to riparian trees" (line 67).

Response: *We have added the tree or leaf in front of "WUE" and specified the "RWC to riparian trees" throughout the manuscript.*

36. Comment:

Line 75: Water table depth: of groundwater?

Response: *We have changed the "water table depth" to "depth of water table".*

37. Comment:

Lines 82-88: Great, very clear objectives here.

Response: *Thanks for your positive comments.*

38. Comment:

Line 86: I would specify "tree WUE".

Response: *We have specified WUE as "tree WUE".*

M&M

39. Comment:

Line 94: I think "dried up from X to X" would be more correct. Or "during X up to X"?

Response: *We have changed "dried up during 1999 to 2007" to "dried up from 1999 to 2007".*

40. Comment:

Lines 95-96: The end of the sentence is a bit unclear due to the wording. I would change to "more than 33 km^2 of riparian zone has been revegetated until 2020" or "from 2007 to 2020". Have the trees been planted?

Response: *Yes, trees have been planted. We have changed this sentence to "more than 33 km^2 of riparian zone has been revegetated until 2020".*

41. Comment:

Line 100: I would change to "from April to November 2019 and 2021".

Response: *We have changed it to "from April to November in 2019 and 2021".*

42. Comment:

Line 101: "were collected", not "was".

Response: *We have changed "was collected" to "were collected".*

43. Comment:

Line 104: I think it is "water level gauge".

Response: *We have changed "water gauge" to "water level gauge".*

44. Comment:

Line 105: "from April to November".

Response: *We have changed "during April to November" to "from April to November".*

45. Comment:

Line 106: “with a total precipitation of”.

Response: *We have changed “with total precipitation of” to “with a total precipitation of”.*

46. Comment:

Line 107: I would correct and say “which was 1.8 times higher than for the drier year 2019 (445.6 mm)”.

Response: *We have changed “which was 1.8 times of that in dry year of 2019 (445.6 mm)” to “which was 1.8 times higher than for the drier year 2019 (445.6 mm)”.*

47. Comment:

Line 108: I would also correct here: “fluctuated between X and X m” and “mean WTD across the three plots”.

Response: *We have corrected “fluctuated at 27.9−28.9 m in 2019 and 27.3−29.7 m in 2021” as “fluctuated between 27.9 and 28.9 m in 2019 and between 27.3 and 29.7 m in 2021”. The “mean WTD in three plots” has been changed to “mean WTD across the three plots”.*

48. Comment:

Line 109: Use “higher” not “larger” to compare values. Also, change to “higher than in X”.

Response: *We have used “higher” to compare values. The “larger than that in 2021” has been changed to “higher than in 2021”.*

49. Comment:

Lines 109-110: Is it not the opposite? The WTD is lower (shallower GW) closer to the stream (see Figures 1 and 3).

Response: *We have changed this sentence to “The WTD increased with increasing distances from the riverbank in both 2019 and 2021 (Fig. 3).”*

50. Comment:

Lines 112-113: Please write the months in full.

Response: *We have spelled out the months. The corrected sentence is as follows: "Twelve sampling campaigns on May 5, June 14, July 26, August 15, September 26, November 5 in 2019 and April 24, May 25, June 26, July 15, September 1, November 5 in 2021 were conducted to collect groundwater, river water, soil, stem, and leaf samples."*

51. Comment:

Line 132: I would say "extract water from xylem and soil samples" instead.

Response: *We have changed "extract water in stem and soil samples" to "extract water from xylem and soil samples".*

52. Comment:

Line 133: "above 99%".

Response: *We have changed "more than 99%" to "above 99%".*

53. Comment:

Line 137: I would use "xylem" rather than "stem" in this section.

Response: *We have used "xylem" rather than "stem" in this section.*

54. Comment:

Line 138: Correct to "for both the IRIS and IRMS systems".

Response: *We have changed "between the IRIS and IRMS systems" to "for both the IRIS and IRMS systems".*

55. Comment:

Lines 141-151: It is a clear section, but I am not familiar with ^{222}Rn and don't really understand the sentence on lines 145-146 "to ensure… less than 80 Bq/m^3". Can you clarify?

Response: *We have added more information about "to ensure… less than 80 Bq/m^3". "The air ^{222}Rn concentration values in the ^{222}Rn monitor (C_{Air}, Bq/m^3) were recorded at 10-minute intervals. The air inside the measurement set-up had contained a certain ^{222}Rn concentration right before injecting the water sample (C_{System}, Bq/m^3). It is generally assumed that the already existing C_{System} can be* *ignored accordingly when C_{System} is around or lower than 80 Bq/m^3. In this study, more than four intervals were conducted to ensure that the C_{System} was less than 80 Bq/m^3. The measurement range of C_{Air} was 2–2,000,000 Bq/m^3 with a measurement precision of 3%. The above measured C_{Air} value was not yet the ^{222}Rn concentration in the measured water sample (C_{water}), because the ^{222}Rn driven out had been diluted by the air within the ^{222}Rn monitor and a small part of the ^{222}Rn remained diluted in the watery phase."*

56. Comment:

Lines 153-156: I feel that these sentences do not belong here but in the introduction, for me the section starts on line 156 at "in this study…".

Response: *We have deleted these sentences in the M&M part and moved them to the introduction part.*

57. Comment:

Line 157: I would correct with "isotopes were integrated/used within/in the MixSIAR model and an iteration method was proposed to identify.". What do you mean by the "original"?

Response: *We have corrected with "In this study, water stable isotopes (δ^2H and $\delta^{18}O$) were integrated within the MixSIAR model and an iteration method was proposed to identify the contributions of the indirect river water that recharged riparian deep water to riparian S. babylonica trees (Figs. 4 and 5)". The "original" means that the total river water contribution to riparian deep water during the entire period of river losing flow to riparian deep zone since 2007. We have changed "original" to "total" and added more explanation about the total river water contributions in section 2.4.3. Here is the revised part: "It was worth noting that riparian deep soil water (80−170 cm layer) and groundwater can be recharged by river water continuously, when the groundwater levels lied below the riverbeds (i.e., losing rivers). The total RWC to riparian deep water should be explicitly identified during the entire period of river losing flow to riparian deep zone since 2007, although the proportional contribution of old (before t-1) river water for riparian deep water might be small."*

58. Comment:

Lines 158-159: I am not sure “merge” is the correct word, please correct the wording and grammar of the sentence.

Response: *We have changed the “merged” to “recharged”. This sentence has been corrected as follows: “In this study, water stable isotopes (δ^2H and $\delta^{18}O$) were integrated within the MixSIAR model and an iteration method was proposed to identify the contributions of the indirect river water that recharged riparian deep water to riparian S. babylonica trees (Figs. 4 and 5)”.*

59. <u>Comment:</u>

Lines 159-163: I would check the wording of these sentences, I found it difficult to understand (maybe follow the section titles you used for 2.4.1., 2.4.2. and 2.4.3.? – they are clear). For example, what do you mean by “root water uptake patterns”? The sources? “Without considering river water as a direct water source”? Also, using “figured out” connotes a lack of accuracy, so I would use “determined” instead, for example.

Response: *We have changed the “root water uptake patterns” to “direct water source (including soil water at three different layers and groundwater) contributions to riparian trees”. We have deleted “without river water as a direct water source” and changed “figured out” to “determined”. The sentences have been corrected as follows: “Firstly, the direct water source (including soil water at three different layers and groundwater) contributions to riparian trees were determined via δ^2H and $\delta^{18}O$ in different waters and the MixSIAR model. Secondly, the proportional contributions of river water to riparian deep water (i.e., riparian groundwater and deep soil water in the 80−170 cm layers) were determined by the MixSIAR model and water isotopes. Finally, the proposed iteration method was used to quantify the proportions of the indirect RWC to riparian trees (Figs. 4 and 5).”*

60. <u>Comment:</u>

Lines 165-168: I found these sentences difficult to understand, I would check the wording. What do you mean by “which was mixed proportionally”, “relatively stable” in terms of seasonal variations in SWC, water isotopes and WTD”? I am also not sure these sentences are needed here.

Response: *We have carefully checked the wording of theses sentences and deleted “which was mixed proportionally with precipitation, old soil water, or even river water and groundwater” as* *well as "relatively stable". However, these sentences were needed to define the direct water sources for riparian trees in the MixSIAR model, which was critical to identify the contributions of indirect river water source to riparian trees.*

"Soil water at different depths was taken up by riparian S. babylonica directly. We measured soil water isotopes at 11 depths in the three plots. In order to reduce errors in the analytical procedure, four soil layers (0−30 cm, 30−80 cm, 80−170 cm, and 170−300 cm) were divided to identify the main root water uptake depth of riparian trees according to seasonal variations in the SWC, water isotopes and WTD. The average soil water isotopes values at depths of 0−5 cm, 5−10 cm, 10−20 cm, and 20−30 cm were calculated for the 0−30 cm soil layer, because the water isotopes went through strong evaporation and the SWC varied significantly seasonally. The soil water isotope values at depths of 40−60 cm and 60−80 cm were averaged for the 30-80 cm soil layer, and those values at 90−110 cm and 150−170 cm depths were averaged for the 80−170 cm soil layer as the water isotopes and SWC were relatively stable. The average isotopes values of soil water at deep depths (190−210 cm, 250−270 cm, and 280−300 cm) were calculated for the 170−300 cm soil layer, which varied with the fluctuations of water tables. Groundwater could also be regarded as a direct water source for phreatophyte riparian trees (Dawson and Ehleringer, 1991; Busch et al., 1992). As the isotopic composition of soil water in the 170−300 cm layer was similar to that of groundwater, they were considered to be one water source (groundwater)."

61. Comment:

Line 170: I don't understand why you refer to Figures 2, 3 and S1 here, I don't see the link with why you separated the soil in 4 layers. Correct "in the 170-230 cm layer".

Response: *We have deleted the Figures 2, 3, and S1 here and changed "in 170-300 cm layer" to "in the 170-300 cm layer".*

62. Comment:

Line 172: I would change "determined" to "used as direct water sources".

Response: *We have revised it as suggested.*

63. Comment:

Lines 173-174: I would change “stem” to “xylem” since you measured isotopes of xylem water.

Response: *We have changed “stem water” to “xylem water” when we referred to “measured isotopes of xylem water” throughout the manuscript.*

64. Comment:

Lines 177-179: I don’t think these sentences are needed here since you develop this point in section 2.4.2.

Response: *We have deleted this sentence in this paragraph.*

65. Comment:

Line 181: I would specify “deep soil water (80-170 cm) and groundwater”, also check grammar of the sentence.

Response: *We have changed this sentence to “riparian deep soil water (80−170 cm) and groundwater can be recharged by river water continuously, when the groundwater levels lied below the riverbeds (i.e., losing rivers).”. We also corrected the wording and the grammar mistakes throughout the manuscript.*

66. Comment:

Lines 181-184: There are some wording and grammatical mistakes I think. Change “could be” by “can be”? “were applied” by “were used”? “in the 80-170 cm layer”.

Response: *We have corrected “could be” as “can be” and changed “were applied” to “were used”. We have modified all the “in ... cm layer” to “in the ... cm layer” throughout the manuscript.*

67. Comment:

Lines 183-190: I like this part, it’s clear, and the Figure S2 is great! I just wonder if it would be better to have the figure in the main text rather than in the Supplement.

Response: *We have moved the Figure S2 to the main text (See Fig. 4).*

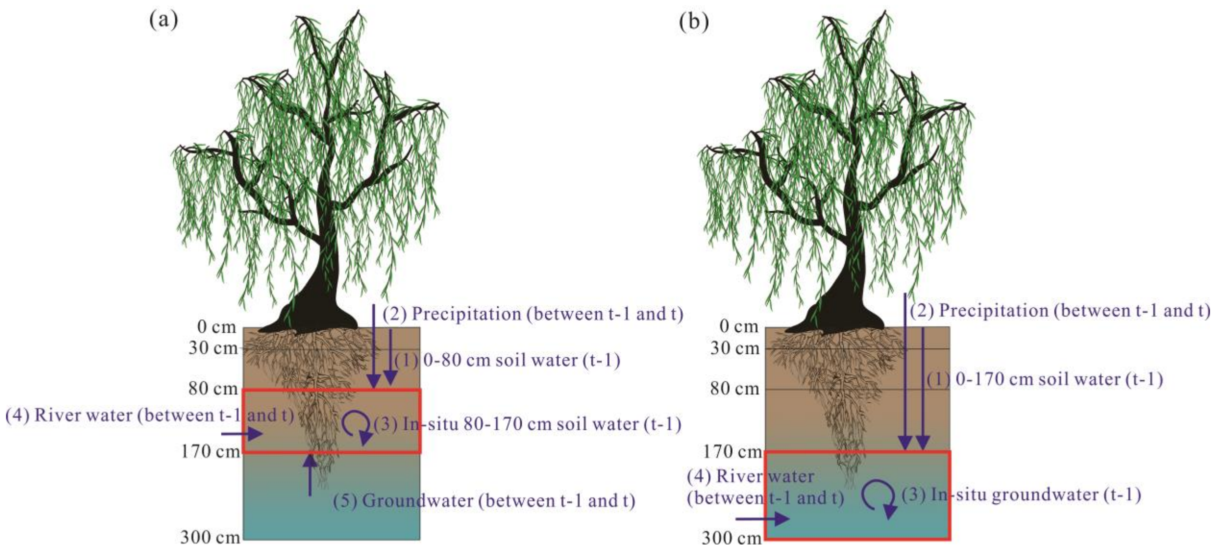

Figure 4: Schematic diagram for potential water sources of (a) riparian deep soil water in 80−170 cm layer and (b) groundwater.

68. Comment:

Lines 191-192: I am not sure about the wording here: "recharged from the river to the underlying aquifer and/or riverbank"… or maybe I misunderstood.

Response: *We have changed "the residence time of groundwater recharged from the river to the underlying aquifer and/or riverbank" to "the residence time of recharged groundwater from river water".*

69. Comment:

Line 199: I would not use "figured out" in a manuscript, I would use "determined" instead. Please correct the "figured out" throughout the manuscript.

Response: *We have changed "figured out" to "determined" throughout the manuscript.*

70. Comment:

Line 200: I am not sure about the use of "merge" here.

Response: *We have changed "merged" to "recharged".*

71. Comment:

Line 202: What do you mean by "be consistent"? Can you change "proportions" to "contribution"?

Response: *We have changed "be consistent" to "be same" in this sentence. And we have modified "proportions" to "contributions".*

72. <u>Comment:</u>

Line 222: I am not sure "recharge" is the best word, maybe say "we estimated the proportions of old and current river water in the riparian deep water", but should it be "in the riparian trees" instead (the aim of the section 2.4.3.)?

Response: *Yes, we have changed this sentence to "Using this proposed iteration method, we estimated the total proportions of old and current river water in the riparian trees.".*

73. <u>Comment:</u>

Lines 224-229: This section is a bit difficult to read, the first sentence it too long, I would try to separate it. Also, check the grammar and wording. The "regression analysis method" is unclear.

Response: *We have carefully checked the grammar and wording of this section. The revised section is as follows: "One-way analysis of variance (ANOVA) incorporating with Kolmogorov-Smirnov, Levene's and post-hoc Tukey's tests ($p < 0.05$) were used to investigate the statistic differences of different variables. These variables included the WTDs, SWC, δ^2H and $\delta^{18}O$ in different water sources and xylems, ^{222}Rn concentration of river water and groundwater, source water contribution to riparian deep water as well as trees, and leaf $\delta^{13}C$ values in the three plots in 2019 and 2021. In order to get the general relationships (not only available for 2019 dry year but also for 2021 wet year) between the WTD, leaf $\delta^{13}C$ values and RWCs to riparian trees, the linear regression model using for quantifying their relationships was fitted to the whole dataset in both two years. The statistical analysis was performed in the Excel (v2016) as well as SPSS (24.0, Inc., Chicago, IL, USA)."*

RESULTS

74. Comment:

This section is well-organized and the results are presented concisely and quite clearly. There are some grammar and wording mistakes, especially when you present the isotopes results. You can't say "d^{2}H in precipitation was more depleted", but say "precipitation was more depleted in d2H" or "d2H in precipitation was higher/lower than…". Check throughout the section 3.1 (lines 232, 239, 240, 242-243, 244-245…). Also, you use a lot of "than these/that" (line 233) or "with that in" (line 236) to compare results between years, I would correct and use "than in" or "compared to" instead. Check also the use of "the".

Response: *Thanks for your helpful comments and suggestions. We have corrected the grammar and wording mistakes throughout the manuscript. The presentation of the isotopes results has been corrected as suggested throughout the manuscript. The incorrect words (including "than these/that", "with that in", and et al) were changed to "than in" or "compared to" in order to compare results between years. We also corrected the use of "the".*

75. Comment:

Line 232: I would not use "it was evident", just present the results clearly and briefly.

Response: *We have deleted "it was evident".*

76. Comment:

Line 234: Use "higher" rather than "larger" to compare values.

Response: *We have changed "larger" to "higher" throughout the manuscript.*

77. Comment:

Line 236: I would rather say "SWC of each soil layer" than say "of all four layer", at the first read I thought you combined all the soil layers together but you analyzed the difference between the plots for each soil layer separately from what I understood.

Response: *We have changed "SWC of all four soil layers" to "SWC of each soil layer".*

78. Comment:

Lines 246-253: This part reads better, it's clear and concise.

Response: *Thanks for your positive comments.*

79. Comment:

Line 250: I would correct to "decreased with increasing distance from the riverbank".

Response: *We have corrected to "decreased with increasing distance from the riverbank".*

80. Comment:

Line 253: What do you mean by "evidently"? Is it significant? and "plummeted"?

Response: *We have changed "evidently" to "significantly ($p < 0.05$)" and added the significance after plummeted "plummeted significantly ($p < 0.05$)".*

81. Comment:

Lines 255-278: This section reads well and is well organized, check the mistakes I referred to previously. I would remove the first sentence and would go straight to the results.

Response: *We have corrected the wording, grammar, and other mistakes throughout the whole section. We have also removed the first sentence of this section and went straight to the results.*

82. Comment:

Line 257: I am not sure about the use of the word "in-situ" to refer to the water that is already in the deep soil or groundwater compartment… But I don't really what word you could use instead so I'm not very helpful on this point.

Response: *Thanks for your comments. We have explained the meaning of "in-situ" word at the first use in the text. Here is the revised part: "The potential water sources of riparian deep soil water in the 80−170 cm layer at t included the in-situ (i.e., the water that is already in the deep soil or groundwater compartment) soil water in this layer at t-1, soil water in the 0−80 cm layer at t-1, river water between t-1 and t, precipitation between t-1 and t, and groundwater between t-1 and t (Fig. 4a)."*

83. Comment:

Line 261: "15.7%".

Response: *We have changed "15.7" to "15.7%".*

84. Comment:

Line 262: "deep soil water", "the lowest", "and in June".

Response: *We have corrected them as suggested.*

85. Comment:

Line 265: I would correct: "significant interannual and seasonal differences in the water sources…".

Response: *Thanks a lot for your suggestion. But we have deleted this sentence and went straight to the results according to the reviewer's comment # 81.*

86. Comment:

Lines 268-269: Please correct the wording of this sentence.

Response: *We have changed this sentence to "The average contribution of river water to riparian groundwater was 28.1 ± 12.1% during the observation period.".*

87. Comment:

Lines 271, 272: You should refer to Figure 3 here to help the reader understand since you present some of the WTD results.

Response: *We have referred to Figure 3 in this sentence.*

88. Comment:

Lines 275-276: As I mentioned before, I still don't understand this sentence, maybe a wording mistake or me… Check the grammar as well.

Response: *We have changed the negative residence time "−0.09 ± 0.09 days" to "0" in this sentence. We also corrected the grammar mistake and revised it as follows: "The T_{res} of recharged groundwater from river water increased from D05 (0 days) to D45 (0.15 ± 0.13 days) (Table 2)." (see the response to the comment #20)*

89. Comment:

Line 282: Please put the unit “%” after each result, “mean of X% ± X%”, check and correct throughout the manuscript.

Response: *We have put the unit “%” after each result and corrected throughout the manuscript.*

90. Comment:

Lines 282, 284, 285, 286: Correct the grammar: “higher” not “more” or “larger”, “lowest” not “least”, “highest” not “most” to compare values. You can say “X was higher/lower than X” or “X was the highest/lowest in…”.

Response: *We corrected this grammar mistake throughout the manuscript.*

91. Comment:

Lines 288-291: Use “between” not “among” to make comparisons. The first part of second sentence is perfect but the end is unclear “whereas….. in 2021” (“corresponding value”?, “along the distances”?), please correct the wording and grammar, or you could just say that there was no significant differences in 2021.

Response: *We have changed “among” to “between” to make comparisons throughout the manuscript. The end part of second sentence has been changed to “whereas there was no significant differences in 2021 ($p > 0.05$) (Fig. 10).”*

92. Comment:

Line 292: I would slightly change the title to: “relationships between leaf $d^{13}C$, RWC to riparians trees and WTD”.

Response: *We have corrected this presentation as suggested throughout the manuscript.*

93. Comment:

Lines 293-298: Check the wording and grammar mistakes (“the” missing, “higher” not “larger”, “significant” not “significantly”…) as commented above, write the months in full, use “significant” instead of “remarkably” (line 294).

Response: *We have corrected this paragraph as suggested. The revised version is as follows:*

"The leaf $\delta^{13}C$ of riparian S. babylonica trees was significantly higher in 2019 (−27.7% ± 1.0 ‰) than in 2021 (−29.7% ± 0.7 ‰) ($p < 0.05$) (Table 1). There was a significant increase of the leaf $\delta^{13}C$ from D05 (−28.8‰) to D45 (−27.0‰) in 2019 ($p < 0.05$), while no significant difference in the leaf $\delta^{13}C$ was observed between the different distances in 2021 ($p > 0.05$). The lowest leaf $\delta^{13}C$ value of riparian trees occurred on August 15 in 2019 and July 14 in 2021, before when the intense rainfall occurred in both years."

94. Comment:

Lines 299-304: This section reads better. Correct "RWC to riparian trees". I would move the last sentence to the discussion section.

Response: *We have corrected "RWC to riparian trees". And we have moved the last sentence to the discussion section.*

DISCUSSION

95. Comment:

The flow of your thoughts is difficult to follow, I would try to be clearer in my explanations. There are wording and grammar mistakes that need to be corrected, also check the tense you use.

Response: *We have rewritten the whole discussion part and corrected the wording and grammar mistakes as well as tense mistakes (see the revised discussion section in response to the comment #1).*

96. Comment:

Line 307-326: The section is well-organized but you don't need to repeat the results in this section (lines 307-310, 316-317, 324-325).

Response: *We have deleted the results and discussed the potential processes and implications in this section. We also compare our results with previous work and provided more explanations for the reasons.*

97. Comment:

Line 311: I find it difficult to understand what do you mean by "contradictions", please develop your thoughts and the processes involved.

Response: *We have deleted the vague "contradictions" and rewritten this part. We also developed and made a complete story including my thoughts, potential processes, and implications. The revised part has been specified in the response to comment #1 (The first paragraph of the 4.2 discussion part).*

98. Comment:

Line 311: I would be more precise and not use "interactions", we don't know if it is river-GW flow or GW-river flow, in your study you only looked at river-GW flow, say it.

Response: *In our study, there was only the process of river water recharging the groundwater system. We have changed the confusing word "interactions" to "river recharging the groundwater system" throughout the manuscript.*

99. Comment:

Line 321: Same comment for "exchange", it is not clear enough.

Response: *We have also changed the confusing word "exchange" to "river recharging the groundwater system" throughout the manuscript.*

100. Comment:

Line 323: I don't think that "weakened" is the right word to use here.

Response: *We have deleted "weakened" and rewritten these sentences. The revised part is as follows: "Although there was no significant difference in the deep water (below the 80 cm layer) contributions to riparian trees between three plots, we observed the substantial effect of the declining water table with increasing distance from the riverbank on the reduced indirect RWCs to riparian trees in dry 2019 (Fig. 10). Therefore, the temporal and spatial variabilities of the RWC to riparian S. babylonica trees generally attributed to the various RWCs to riparian deep water rather than the water use patterns of riparian trees."*

101. Comment:

Line 326: "distance" from what?

Response: *We have specified "distance from the riverbank" throughout the manuscript.*

102. Comment:

Lines 329-335: The section here is also well-organized but I still find it difficult to follow your story.

Response: *We have rewritten this part to make a clearer story including my thoughts, potential explanations for small RWCs to riparian trees, comparison with previous studies and corresponding explanations. The revised part has been specified in the response to comment #1 (The first and second paragraphs of the 4.2 discussion section).*

103. Comment:

Line 329: You can say "smaller than.." or say "small", please correct.

Response: *We have changed "smaller" to "small".*

104. Comment:

Lines 331-335: I like this part, just check the grammar and wording ("or that stored").

Response: *Thanks for your positive comment. We have combined this part with the potential explanations for small RWCs to riparian trees in the 4.2 section part to make the story clearer. The revised part has been specified in the response to comment #1 (The first paragraph of the 4.2 discussion section).*

105. Comment:

Line 346: Here and throughout the manuscript, don't forget: "RWC to riparian trees".

Response: *We have corrected "RWC to riparian trees" throughout the manuscript.*

106. Comment:

Line 347-349: These 2 sentences should be switched, I would first briefly remind the result and then say what it suggests, you did the opposite here.

Response: *We have switched these two sentences and rewritten this part to make it clearer.*

107. Comment:

Line 349: I would reword “along the gradient of distance”.

Response: *We have changed “along the gradient of distance” to “with increasing distance from the riverbank”.*

108. Comment:

Line 351: The technical word “dimorphic” should be explained at first use to help the nonexpert reader to understand what you mean.

Response: *We have explained the meaning of “dimorphic” root systems at first use. The “dimorphic” root systems can help plant species to shift their main water sources between shallow and deep layers. Here is the revised part: “Our result contrasts with the previous study by Qian et al. (2017) who reported a significant increase of the RWC to G. biloba trees in response to the water table decline. It was ascribed to that riparian G. biloba had a dimorphic root system and shifted their main water sources from shallow soil layer to deeper soil layer. Nevertheless, the potential root growth rate of riparian phreatophyte S. babylonica trees can reach 1-13 mm/day, which allows the riparian S. babylonica trees to remain in contact with a rising/declining water table and keep constant water uptake proportions from deep strata below the 80 cm depth in this study (Naumburg et al., 2005).”*

109. Comment:

Lines 351-355: Interesting difference between tree species, try to reword to clarify this point. The sentence on lines 354-355 is repeating the one on lines 351-353.

Response: *We have rewritten these sentences to clarify the difference between tree species. The revised part has been shown in the comment #108.*

110. Comment:

Line 357: I don’t think “balance and coordination” are the right words here.

Response: *We have deleted the word “balance and coordination” and improved the wording of this sentence as follows: “Therefore, understanding what water sources and how much river water are used by riparian trees as well as the responses of plant water use characteristics to groundwater* *level variations can help to control the river runoff and tree water requirement of revegetated riparian zones."*

111. Comment:

Lines 361-369: I like the ideas here but I would improve the wording and check the grammar to improve the flow.

Response: *We have rewritten and improved the flow of this part to make a complete story including our thoughts, potential processes, and implications. The revised part has been specified in the response to comment #1 (The first paragraph of the 4.2 discussion section part).*

112. Comment:

Line 362: "profligate" is not the right word here; it can't be used to describe water-use strategy.

Response: *We have modified "profligate water use strategy" to "consumptive water use strategy"*

113. Comment:

Line 366: Say "river water" not "river flow".

Response: *We have corrected it throughout the manuscript.*

114. Comment:

Lines 371-374: This is results, not discussion.

Response: *We have deleted these results and rewritten this part.*

115. Comment:

Lines 375-380: I like the ideas here; grammar and wording need to be improved.

Response: *We have rewritten this part and improved the grammar and wording. The revised part has been specified in the response to comment #1 (The second and third paragraphs of the 4.3 discussion section).*

116. Comment:

Line 375: Correct the grammar: "previous studies that showed an…".

Response: *We have corrected as suggested.*

117. Comment:

Line 376: No need to add the equation.

Response: *We have deleted the equation.*

118. Comment:

Line 377: I think "coordinate" is not the right word here, maybe "optimize"?

Response: *We have changed "coordinate" to "optimize".*

119. Comment:

Line 379: I would reword "balancing the relationship" and "flow reservation".

Response: *We have deleted these words and rewritten these sentences. The revised part is as follows: "Therefore, the relationships between the RWC to riparian trees, leaf-level physiological characteristics (e.g., leaf WUE) and hydro-meteorological conditions are critical and helpful for the better protection of the riparian forest while maintaining sustainable river runoff."*

120. Comment:

Line 383: I would say "groundwater table" rather than "water table", it is clearer, please check throughout the manuscript

Response: *Thanks a lot for your comments. But we prefer to use "water table" throughout the manuscript. The "water table" is more official to define "the upper surface of the saturated zone". It has been widely used in many official websites and academic journals (e.g., https://www.usgs.gov/faqs/what-groundwater and https://education.nationalgeographic.org/resource/water-table).*

121. Comment:

Lines 386-397: I find the flow of this section hard to follow, thoroughly check the wording and grammar, don't hesitate to ask an English native speaker.

Response: *We have rewritten this part thoroughly and invited an English native speaker to help* *check the wording and grammar.*

CONCLUSION

122. Comment:

Lines 399-412: Check and correct the wording and grammar.

Response: *We have corrected the wording and grammar in this part.*

123. Comment:

Lines 399-401: I like this part, reminding the objective of the study.

Response: *Thank you for the positive comments.*

FIGURES

124. Comment:

Figure 1: Great figure!! It is very clear, easy to read and show all the info needed. As I see dams along the river, I wonder if water was released during the study periods and how it could have affected river flow and the results?

Response: *Thanks for your positive comments. Due to continuous drought and groundwater overexploitation, the Chaobai River dried up from 1999 to 2007. The ecological water (including reclaimed water, reservoir water, and diverted water by the South-to-North Water Transfer Project) has been supplied to restore this dry river via a systematic water release by dams since 2007. A total of 51.1 million and 380 million cubic meters of ecological water sources were released to the Chaobai River in 2019 and 2021, respectively. This significantly different amount of ecological water release between two years led to a remarkable discrepancy in water table between dry 2019 and wet 2021 (Fig. 3). Moreover, the dams along the Chaobai River are used to regulate the river water level especially in flood season, which has a great effect on the river runoff and thus the riparian groundwater level. However, little was known about the effects of the river water level/groundwater level on the water use characteristics of riparian trees. Therefore, our study aims* *at understanding the RWC to riparian trees and their responses to groundwater level variations. This could help to control the river runoff and tree water requirement of revegetated riparian zones.*

125. Comment:

Figure 2: Check the reference to Figure 2 in the text, lines 106-107 should only refer to Figure 2a. I would change the caption to "Monthly average precipitation amount from 1961 to 2021 and monthly total precipitation amount for the observation years 2019 and 2021 (a), Daily total precipitation amount and precipitation isotopes during 2019 (b) and 2021 (c).

Response: *We have changed the reference to "Figure 2b and c" in the text to "Figure 2a". And we modified the caption to "Monthly average precipitation amount from 1961 to 2021 and monthly total precipitation amount for the observation years 2019 and 2021 (a), Daily total precipitation amount and precipitation isotopes during 2019 (b) and 2021 (c)".*

126. Comment:

Figure 3: The figure is clear but I would show groundwater level (on same scale as river water level) instead of water table depth so we can actually compare with river water level, but maybe I'm being too picky if the aim of the figure is only to show the seasonal variations.

Response: *This is a good comment. We have shown the groundwater level, water table depth, river water level in Fig. 3. We have also added the elevation of riverbed (26.0 m) as well as the riparian ground surface elevation (29.5 m) in the captions in order to indicate the groundwater level. The revised Fig. 3 is as follows:*

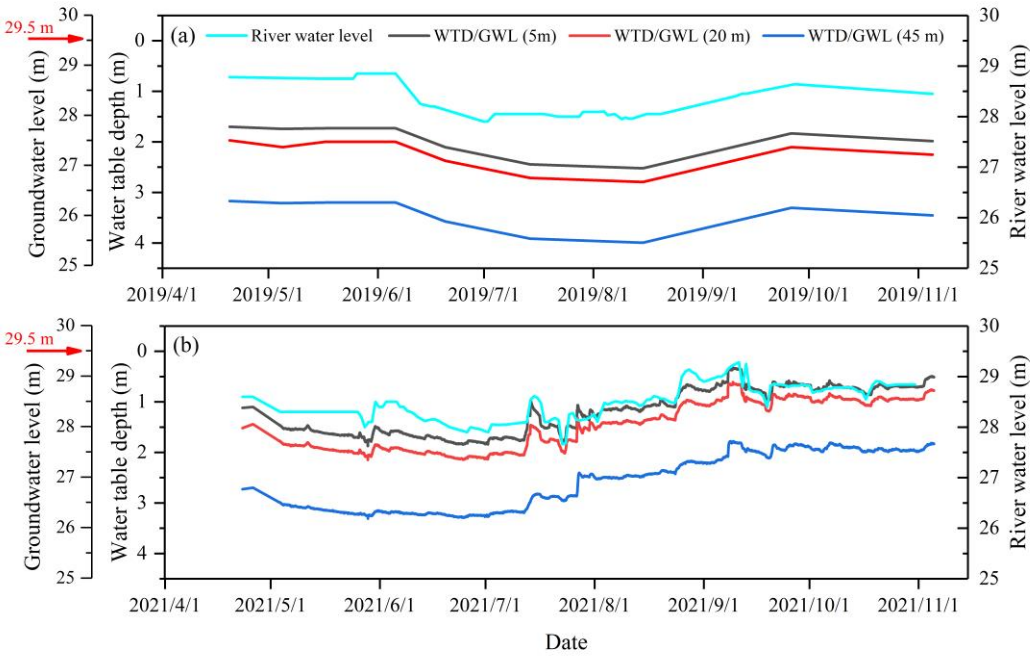

Figure 3: Seasonal variations of the river water level and depth of water table (WTD)/groundwater level (GWL) at distances of 5 m, 20 m, and 45 m away from the riverbank during the observation period in 2019 (a) and 2021 (b). The red arrow indicates the riparian ground surface level (29.5 m). The riverbed level is 26 m.

127. Comment:

Figure 4: Nice flowchart, the reference is missing in the text.

Response: *Thanks for your positive comment. We have added the reference of Figure 4 in the text.*

128. Comment:

Figure 5: This is again a very nice figure. I would check and correct the wording of the caption (3 first sentences). Maybe try to increase the front size? I would use xylem instead of stem, as suggested before.

Response: *Thanks for your positive comment. We have checked and corrected the wording of the three first sentences in the caption. We also increased the front size and changed "stem water" to "xylem water".*

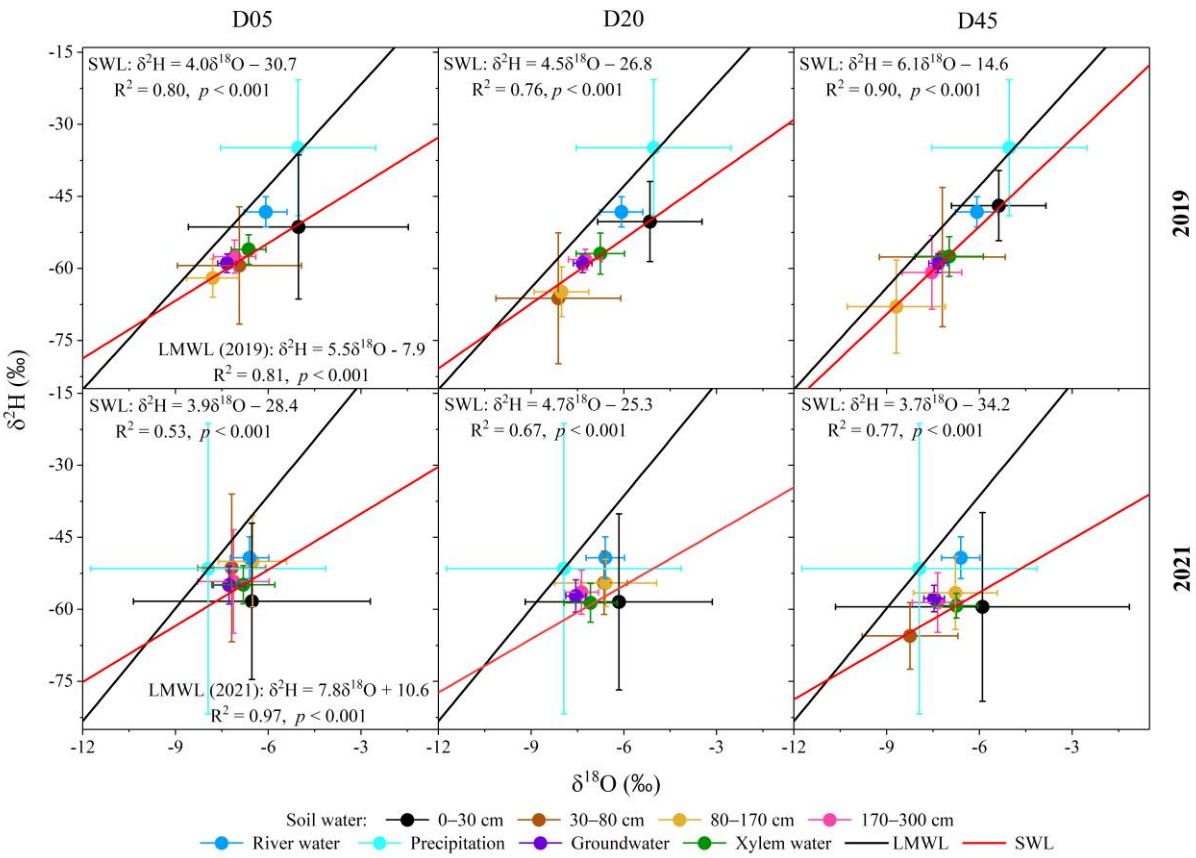

Figure 6: Dual-isotope (δ^2H and $\delta^{18}O$) biplots of different water bodies in the three plots (D05, D20, and D45) for the observation years 2019 and 2021. The local meteoric water line (LMWL) was fitted by precipitation isotopes for each year. The soil water line (SWL) was fitted by the soil water isotopes in the four layers across three plots (D05, D20, and D45) for each year. D05, D20, and D45 are the plots at distance of 5 m, 20 m, and 45 m away from the riverbank, respectively. The error bars indicate standard deviations.

129. Comment:

Figure 6: Very nice figure, I would however correct the caption with "Seasonal variations in the (proportional) contributions of soil water and groundwater to riparian trees in the three plots.". Try to increase the front size.

Response: *Thanks for your positive comment. We have changed the confusing sentences "Seasonal variations in the proportional contributions of soil water and groundwater to riparian trees in the three plots…" to "Seasonal variations in the proportional contributions of soil water and groundwater to riparian trees in the three plots (D05, D20, and D45) for the observation years*

2019 (a−c) and 2021 (d−f).". And we also increased the front size.

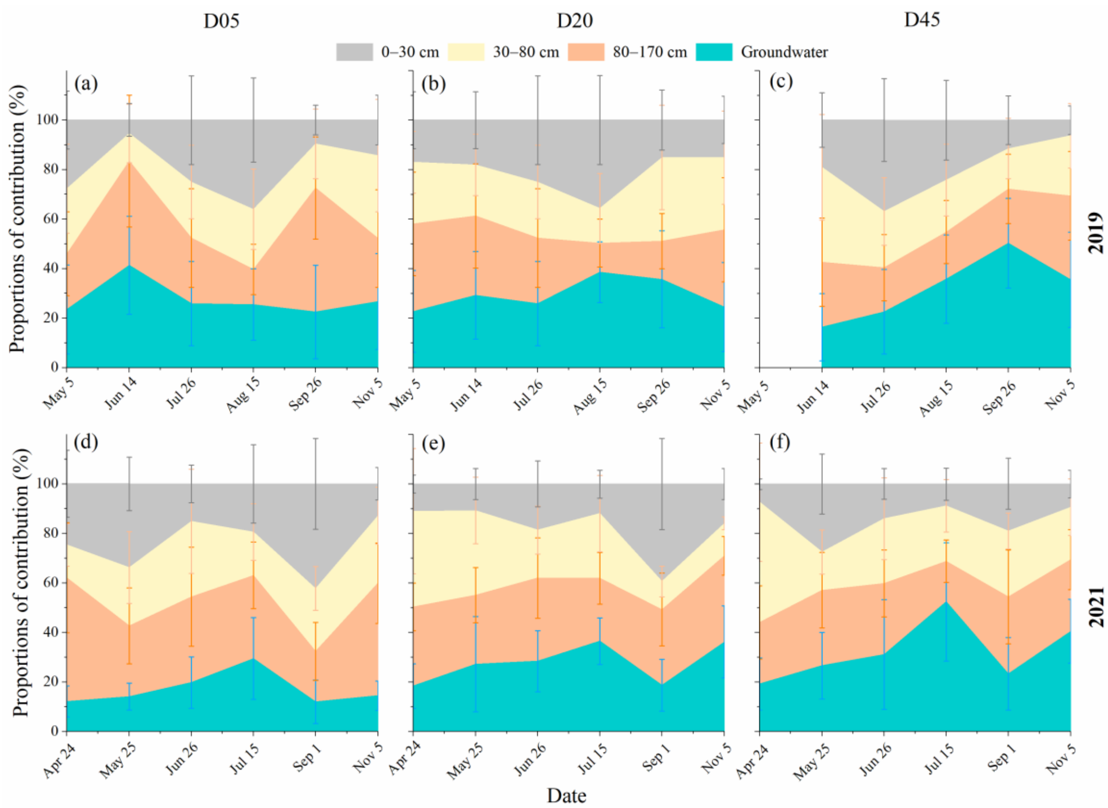

Figure 7: Seasonal variations in the proportional contributions of soil water and groundwater to riparian trees in the three plots (D05, D20, and D45) for the observation years 2019 (a−c) and 2021 (d−f). D05, D20, and D45 are the plots at distance of 5 m, 20 m, and 45 m away from the riverbank, respectively. The error bars indicate standard deviations.

130. Comment:

Figure 7: Nice figure, correct the "in-situ" in the legend at the top of the figure and the y axis "contributions of water sources to riparian soil water in the 80-170 cm layer in the three plots", check the grammar in the caption. I would increase the front size as well.

Response: *We have corrected the "in-situ" in the legend at the top of the figure and the y axis "contributions of water sources to riparian soil water in the 80-170 cm layer in the three plots". We also modified the grammar in the caption and increased the front size.*

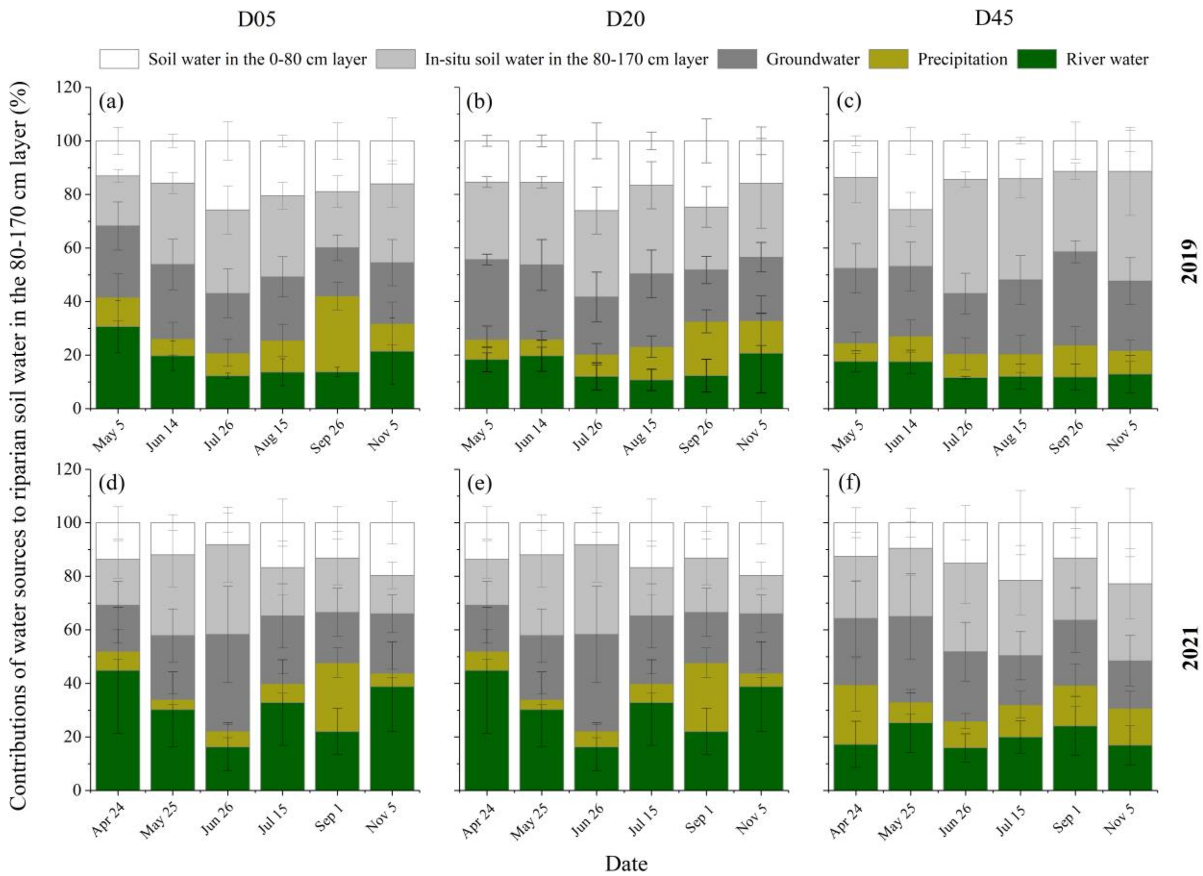

Figure 8: Seasonal variations in the different water source contributions to riparian deep soil water in the 80−170 cm layer in the three plots (D05, D20, and D45) for the observation years 2019 (a−c) and 2021 (d−f). D05, D20, and D45 are the plots at distance of 5 m, 20 m, and 45 m away from the riverbank, respectively. The error bars indicate standard deviations.

131. Comment:

Figure 8: Nice figure as well, just correct the "in-situ" in the legend, check the caption and try to increase the front size.

Response: *We have modified the "in-situ" in the legend as well as the grammar in the caption. We also increased the front size (see the Figure 9 in the response to Comment #1).*

132. Comment:

Figure 9: Nice and clear figure, correct the y axis "contributions of river water to riparian trees", I would try to better highlight the yearly average, maybe using bold? I did not notice it at first look. Check and correct the caption: "different letters show a significant difference in the RWC to riparian

trees between two plots", maybe say "RWC to riparian trees in the three plots for each sampling campaign" rather than "seasonal variation" since you only show the statistical results of the differences between plots for a same campaign. The stats results for September 2021 look weird, D45 looks different than D05 and D20 not different from D05 and D45, can you check that?

Response: *We have corrected the y axis "contributions of river water to riparian trees", the caption "different letters show a significant difference in the RWC to riparian trees between two plots", and "RWC to riparian trees in the three plots for each sampling campaign". We highlighted the yearly average using bold fond. Additionally, we have modified the stats results of September 2021 as suggested (see the Figure 10 in the response to Comment #1).*

133. Comment:

Figure 10: Very nice figure as well, maybe just try to increase the front size. Check the grammar in the caption.

Response: *Thanks for your positive comment. We have increased the front size of the caption and modified the grammar in the caption.*

Response to Referee #2 (Dr. Remy Schoppach):

General comments:

1. Comment:

This manuscript from Li et al. aims at quantifying the contribution of river water to the transpiration flux of trees growing in the riparian area. This is an important topic, of interest for the community. Globally, the paper quality suffers from a clear lack of structure, elusive objectives and a poor discussion. Figures are of relatively good quality. Clearly the authors are not native speakers, but the paper remains easily readable from a language perspective, except for the discussion. The effort put in the language is appreciated but the structure and the reasoning need to be substantially improved.

Response: *Thank you for positive comments and insightful suggestions. We have substantially revised the structure, objectives, discussion as well as the wording and grammar mistakes throughout the manuscript. We have reorganized the structure especially in the Introduction, Materials & methods, Results, and Discussion sections.*

In the Introduction, we have made a straightforward flow of ideas leading to a scientific gap that this paper aims to fill. Some sentences which belong to the Introduction rather than M&M have been moved into the Introduction section. We have introduced the use of radon as an indicator and the need of an iteration method (See the response to Comment #2).

In the M&M and Result sections, we have added a separate part of "3.1 Hydro-meteorological conditions" and moved all the hydro-meteorological conditions in the M&M part to the 3.1 section.

We have reorganized the entire Discussion. Firstly, we discussed the strengths/weakness and implications of the MixSIAR model and the iteration method. Secondly, we discussed the RWC to riparian trees and the effects of the distance from the stream and dry/wet year on RWCs to riparian trees. In this part, we have discussed and developed the potential processes. Finally, we discussed the link between RWC/WUE/WTD and developed its implications on management of riparian forest and river runoff. We have compared the results with previous work and provided corresponding explanations throughout the revised Discussion section. The discussion section has been revised thoroughly by means of developing the potential processes, reasons, and implications of our findings.

2. Comment:

Introduction lack of reasoning on the scientific gap. In some parts, it really reads like a discussion where the authors compare contrasting results from the literature without highlighting the questions it raises. Some concepts are not even introduced (e.g., the use of radon as an indicator or the need of an iteration method). The introduction requires a straight flow of ideas leading to a scientific gap that this paper aims to fill. The lack of structure is also visible as some parts of the introduction are displayed in the M&M.

Response: *Thank you for positive comments and insightful suggestions. We have reorganized the Introduction section and improved the flow of ideas leading to a scientific gap that this paper aims to fill. We have highlighted the questions it raised rather than displayed or compared different results from the literature. We added more introductions about the use of radon as an indicator and the need of an iteration method. Some sentences which belong to the Introduction rather than the M&M have been moved into the Introduction.*

Specific comments:

Abstract

3. Comment:

Line 16: write active. We propose instead of "were proposed"

Response: *We have changed this sentence to "We proposed a new iteration method in combination with the MixSIAR model to quantify the proportional river water contribution (RWC) to riparian S. babylonica and its correlations with the depth of water table (WTD) as well as leaf $\delta^{13}C$."*

4. Comment:

Line 19: contributed by

Response: *We have corrected it as suggested.*

5. Comment:

Line 20: why using "but" instead of "and". Is the increase in river water acquisition in contradiction with the decrease in leaf $\delta^{13}C$? If yes, you need to explain why.

Response: *We have changed "but" to "and". The increase in river water acquisition is not in contradiction with the decrease in leaf $\delta^{13}C$.*

6. Comment:

There is no explanation of the decrease in leaf $\delta^{13}C$ the abstract?

Response: *We have explained the decrease in leaf $\delta^{13}C$ in the Abstract. Here is the revised part: "Significantly increasing river water acquisitions (by 7.0%) and decreasing leaf $\delta^{13}C$ (by −2.0‰) of riparian trees were observed as the WTD changed from 2.7 m in dry 2019 to 1.7 m in wet 2021 ($p < 0.05$). The lower water availability in drier year probably resulted in the plant stomatal closure to minimize the water loss, which consequently enhanced the leaf $\delta^{13}C$."*

7. Comment:

Line 24. How the rising water table would "stimulate" trees to maximize transpiration? I think this is simply the results of a higher water availability leading to a less negative water potential in the root-zone and subsequent lower stomata regulation. There is no clue for any "stimulation" of the plant?

Moreover, the reasoning is a bit ambiguous as you say that a rising water table increases the transpiration and the water extraction from the river (but not from the groundwater?). This is puzzling to me.

Response: *We have deleted the words "stimulate riparian trees to maximize transpiration water consumptions". Riparian trees can take up groundwater directly, while the river water seeped into the groundwater is an indirect water source for riparian trees.*

We have clarified and changed this sentence to "The rising water table would trigger riparian trees to increase the water uptake from the groundwater/river water and show a consumptive water use strategy, which could not be recommended in order to both protect rivers and riparian vegetation."

8. Comment:

Line 27: why using capital letters for Groundwater-Soil-Atmosphere Continuum?

Response: *We have corrected as "groundwater-soil-atmosphere continuum".*

Introduction

9. Comment:

Line 30: I'm not aware of a consequence of groundwater overexploitation on the alteration of precipitation regime. Maybe consider re-writing.

Response: *We have deleted the "precipitation regime".*

10. Comment:

Line 35: contributed "by"

Response: *We have changed "contributed 40%" to "contributed by 40%".*

11. Comment:

Line 38: delete "deeply"

Response: *We have deleted "deeply".*

12. Comment:

Line 39: their responses to the variation in the water table (response of what, transpiration? Variation in what, level?) Please be specific.

Response: *We have changed this sentence to "Therefore, understanding what water sources and how much river water are used by riparian trees as well as the responses of plant water use characteristics to groundwater level variations can help to control the river runoff and tree water requirement of revegetated riparian zones."*

13. Comment:

Line 39: Also, I don't understand how a "deep understanding" could help "balancing the river flow and the revegetated riparian species"? It could help implementing management strategies maybe? But the understanding will not balance anything.

Response: *We have deleted "balance" in this sentence. We changed this sentence to "Therefore,* *understanding what water sources and how much river water are used by riparian trees as well as the responses of plant water use characteristics to groundwater level variations can help to control the river runoff and tree water requirement of revegetated riparian zones"*

14. Comment:

Line 39: Is "revegetated species" an already used term? I'm not native speaker but I don't think a species can be revegetated. A riparian area could be, but not a species, right?

Response: *We have changed "revegetated riparian species" to "revegetated riparian zones".*

15. Comment:

Line 41 to 43: contribution to what? Transpiration flux I guess, but please write it. Please also insert the references within the sentence after each corresponding argument.

Response: *We have changed "the river water contribution (RWC) to riparian trees" to "the river water contribution (RWC) to transpiration flux". We also inserted the references within the sentence after each corresponding argument. The revised part is as follows: "The statistical two- or multi-source linear mixing models (Ehleringer and Dawson, 1992; Alstad et al., 1999) and Bayesian mixing models (MixSIR, SIAR, SISUS, MixSIAR) (Ma et al., 2016; Wang et al., 2019b; White and Smith, 2020; Li et al., 2021) accompanied with stable water isotopes (δ^2H and $\delta^{18}O$) have been widely used to estimate the RWC to riparian trees."*

References:

Alstad, K. P., Welker, J. M., Williams, S. A., and Trlica, M. J.: Carbon and water relations of Salix monticola in response to winter browsing and changes in surface water hydrology: an isotopic study using delta C-13 and delta O-18. Oecologia. 120, 375-385, 1999.

Ehleringer, J. R. and Dawson, T. E.: Water-uptake by plants-perspectives from stable isotope composition. Plant Cell and Environment. 15, 1073-1082, 1992.

Li, Y., Ma, Y., Song, X. F., Wang, L. X., and Han, D. M.: A δ2H offset correction method for quantifying root water uptake of riparian trees. Journal of Hydrology. 593, 125811, doi:10.1016/j.jhydrol.2020.125811, 2021.

Ma Y. and Song X. F.: Using stable isotopes to determine seasonal variations in water uptake of summer maize under different fertilization treatments. Science of the Total Environment. 550: 471-483, 2016.

Wang, J., Fu, B., Lu, N., Wang, S., and Zhang, L.: Water use characteristics of native and exotic shrub species in the *semi-arid Loess Plateau using an isotope technique. Agriculture, Ecosystems & Environment. 276, 55-63, 2019b.*

White, J. C. and Smith, W. K.: Water source utilization under differing surface flow regimes in the riparian species Liquidambar styraciflua, in the southern Appalachian foothills, USA. Plant Ecology. 221, 1069-1082, 2020.

16. Comment:

Line 45: "a separate water source". Separate from what, other sources? If yes, maybe list them.

Response: *We have changed "a separate water source" to "a direct potential water source for riparian trees".*

17. Comment:

Line 53: There was a debate or there is?

Response: *We have changed "There was a debate" to "There is a debate"*

18. Comment:

Line 63: inaccurate estimation of what? Please consider re-writing the entire sentence

Response: *We have rewritten these sentences and clarified the knowledge gap as follows: "There is growing evidence indicating that riparian trees at a certain distance away from the riverbank rarely took up river water directly, because their lateral roots could not reach the river (Mensforth et al., 1994; Thorburn and Walker, 1994). Nevertheless, riparian trees could indirectly utilize the river water seeped into riparian deep zone (including deep soil water and groundwater) when their roots tapped into the groundwater level (Mensforth et al., 1994; Wang et al., 2019b). Treating river water as a direct water source might lead to inaccurate estimations of the RWC to transpiration flux. However, it remains unclear that how to separate and quantify the contribution of the indirect river water source that recharges riparian deep water to transpiration flux of riparian trees nearby losing rivers."*

19. Comment:

Line 65: You can't just state that "how to separate and quantify the contribution of … is a great challenge" without reasoning it. Why is it a great challenge? If you don't explain it, the reader gets confused and can only believe you. You need first to introduce the reasons making this a challenge.

Response: *We have added the explanation of why is "how to separate and quantify the contribution of ..." is a great challenge (see the response to Comment #18).*

20. Comment:

Line 70 to 80 reads like a discussion more than an introduction.

Response: *We have deleted most of the sentences from line 72 to 80 and focused on the scientific gap as well as its corresponding reasons. The modified sentences have been shown as follows: "The RWC to transpiration flux of riparian trees can be quantified indirectly by determining both the RWC to riparian deep water and the water use patterns of riparian trees. A multi-iteration method will help to calculate the proportional contributions of total (old and current) river water to riparian deep water, which could further improve the estimation accuracy of the RWC to tree transpiration flux. The radioactive isotope (^{222}Rn) has been widely used for tracing groundwater origins and the corresponding pathways in riparian zone (Close et al., 2014; Zhao et al., 2018). However, it is unclear about the residence time of recharged groundwater from river water and its effects on the RWC to plant transpiration flux. Moreover, the fluctuation of the depth of water table (WTD) in the riparian zone resulting from changing river water level plays a critical role in the RWC to riparian trees (Horton and Clark, 2001; Liu et al., 2017; Xia et al., 2018). Enhancing understanding of the quantitative relationship between WTD and the RWC to riparian trees will help to determine the optimal water table for maintaining the water source sustainability in the riparian zone beside a losing river. Nevertheless, little attention has been paid to quantifying the relationships between the RWCs to riparian trees and WTD.*

Since leaf $\delta^{13}C$ values are positively related to tree WUE, the leaf $\delta^{13}C$ has been widely used as an indicator of tree WUE for C3 photosynthesis plants (Farquhar et al., 1989). For example, Thorburn and Walker (1994) found that the riparian Eucalyptus camaldulensis beside the ephemeral stream had higher tree WUE with more frequent access to river water based on the leaf $\delta^{13}C$ measurements. However, few studies focused on quantifying the relationships between leaf WUE and the RWC to riparian trees nearby a losing river."

21. Comment:

Line 83: the first objective is the propose an iteration method. This comes from nowhere as no part of the introduction introduce the issue related to iteration methods? Also, what is an iteration method together with water stable isotopes?

Response: *This is a good comment. We have added the detailed information about the newly proposed iteration method in the introduction part. The added items are shown as follows: "The RWC to transpiration flux of riparian trees can be quantified indirectly by determining both the RWC to riparian deep water and the water use patterns of riparian trees. A multi-iteration method will help to calculate the proportional contributions of total (old and current) river water to riparian deep water, which could further improve the estimation accuracy of the RWC to tree transpiration flux."*

We have changed "an iteration method together with water stable isotopes" to "an iteration method together with the MixSIAR model and water stable isotopes".

M&M

22. Comment:

Line 94: has been seriously degraded instead of degraded seriously.

Response: *We have corrected it as suggested.*

23. Comment:

Line 95: What is ecological water? How is that "ecological water" supplied? This part of context is worth being developed a bit more. Is it via a systematic water release by dams?

Response: *We have modified this part as "Due to continuous drought and groundwater overexploitation, the Chaobai River dried up from 1999 to 2007. The "ecological water" (including reclaimed water, reservoir water, and diverted water by the South-to-North Water Transfer Project) has been supplied via a systematic water release by dams to restore this dry river since 2007. A total of 51.1 million and 380 million cubic meters of ecological water sources were released to the Chaobai River in 2019 and 2021, respectively."*

24. <u>Comment:</u>

Line 103: via a pressure stage gauge

Response: *We have corrected it as suggested.*

25. <u>Comment:</u>

Line 108: Fluctuated between

Response: *We have corrected it as suggested.*

26. <u>Comment:</u>

Line 109: The mean WTD in the three plots was significantly ($p<0.5$) deeper in 2019 (value) than in 2021 (value).

Response: *We have corrected it as suggested.*

27. <u>Comment:</u>

Line 105 to 110: Should this section displayed in the Results instead of M&M?

Response: *We have moved these sentences from M&M to the Results section. We added a separate part (3.1 Hydro-meteorological conditions) in the Results section and moved all the hydro-meteorological conditions in the M&M to the 3.1 section.*

28. <u>Comment:</u>

Line 118: There is not mention of the ^{222}Rn in the introduction. Therefore, the reader has no idea what ^{222}Rn is and why you determine the its concentration?

Response: *This is a good comment. We have presented the significance of determining the ^{222}Rn concentration in the Introduction section in this study. The revised part is as follows: "The radioactive isotope (^{222}Rn) has been widely used for tracing groundwater origins and the corresponding pathways in riparian zone (Close et al., 2014; Zhao et al., 2018). However, it is unclear about the residence time of recharged groundwater from river water and its effects on the RWC to plant transpiration flux."*

References:

Close M., Matthews M., Burbery L., Abraham P. and Scott D.: Use of radon to characterise surface water recharge *to groundwater. Journal of Hydrology. 53(2): 113-127, 2014.*

Zhao D., Wang G., Liao F., Yang N., Jiang W., Guo L., Liu C. and Shi Z.: Groundwater-surface water interactions derived by hydrochemical and isotopic (^{222}Rn, deuterium, oxygen-18) tracers in the Nomhon area, Qaidam Basin, NW China. Journal of Hydrology. 565, 650-661, 2018.

29. Comment:

Line 120: Is it Three trees in each of the three plots or one three per plot? Please re-write to avoid confusion.

Response: *We have modified this sentence to "One riparian S. babylonica tree was chosen in each plot for δ^2H and $\delta^{18}O$ measurements in xylem water as well as $\delta^{13}C$ analysis in plant leaves. The mean diameter at breast height of three sampled trees was 28.6 ± 4.4 cm."*

30. Comment:

Line 133: Did you measure the efficiency of the extraction and how? By weighting your fresh and dry samples? Please explain it.

Response: *We have added more information about how to calculate the efficiency of the extraction in this paragraph. For example: "We weighted all the xylem and soil samples before and after extraction and subsequently calculated the efficiency of water extraction in order to ensure the water extraction efficiency higher than 99% and no isotopic fractionation during water extraction process."*

31. Comment:

Line 141: Is there something missing in this sentence. What is exactly C_{Air}?

Response: *We have rewritten this paragraph to make it clear. "The radon (^{222}Rn) concentration in the groundwater and river water samples (C_{Water}, Bq/l) was determined based on the air ^{222}Rn concentration values (C_{Air}, Bq/m^3) measured by a ^{222}Rn monitor (Alpha GUARD PQ2000 PRO, Bertin Instruments, Germany). 100 ml of the water sample was slowly poured into the air-tight glass bottles and then purged with air in a closed gas cycle system. The air ^{222}Rn concentration values in the ^{222}Rn monitor (C_{Air}, Bq/m^3) were recorded at 10-minute intervals. The air inside the measurement set-up had contained a certain ^{222}Rn concentration right before injecting the water sample (C_{System}, Bq/m^3). It is generally assumed that the already existing C_{System} can be ignored* *accordingly when C_{System} is around or lower than 80 Bq/m^3. In this study, more than four intervals were conducted to ensure that the C_{System} was less than 80 Bq/m^3. The measurement range of C_{Air} was 2–2,000,000 Bq/m^3 with a measurement precision of 3%. The above measured C_{Air} value was not yet the ^{222}Rn concentration in the measured water sample (C_{water}), because the ^{222}Rn driven out had been diluted by the air within the ^{222}Rn monitor and a small part of the ^{222}Rn remained diluted in the watery phase."*

32. Comment:

Line 153 to 156: This is introduction, not M&M.

Response: *These sentences have been moved into the Introduction part.*

33. Comment:

Line 160: Based on what did you decided to not consider river water as a direct source for tree water uptake? You have to justify this choice one way or another. Or at least explain it.

Response: *We have added more information on the reason of why we did not consider river water as a direct water source for tree water uptake in the 2.4.1 section.*

"Mensforth et al. (1994) and Thorburn and Walker (1994) characterized the outer projected edge of canopy as the extension range of lateral roots, which could indicate whether riparian trees take up river water directly or not. In this study, the outer projected edge of canopy was less than 5 m for riparian S. babylonica tree closest to the river (5 m away from the riverbank). It indicated that the lateral roots of S. babylonica trees could not tap into the river water. Therefore, the river water was not considered as a direct potential water source for tree water uptake, while the soil water in the 0−30 cm, 30−80 cm, and 80−170 cm layers, and groundwater were considered as the direct water sources for riparian S. babylonica."

34. Comment:

Line 173: What is the correction proposed by Li et al. (2021). Please explain briefly how this works.

Response: *We have added the explanation on how the correction method –PWL correction method works in the section 2.4.1. Here is the revised part: "In this study, the δ^2H offsets between xylem water in riparian trees and its corresponding potential source water were also observed, which* *could be explained by the δ^2H fractionation occurring in the plant water use processes (Li et al., 2021). These δ^2H offsets could lead to inaccuracy estimations in the MixSAIR model. In order to eliminate the δ^2H offsets of xylem water from its potential water sources, the measured xylem water δ^2H values were corrected via the potential water source line (PWL) proposed by Li et al. (2021). The PW-excess (PW-excess = $\delta^2H - a_p\delta^{18}O - b_p$; a_p and b_p were the slope and intercept of the PWL) was calculated to indicate the δ^2H deviation from the PWL, which was subsequently subtracted from the measured xylem water δ^2H values. The corrected δ^2H and raw $\delta^{18}O$ in xylem water were set as the mixture data in the MixSIAR model to quantify the contributions of direct water sources to riparian S. babylonica."*

35. Comment:

Line 183: Try to avoid saying "As shown in figS2a". Just write your sentence and refer to the figure at the end.

Response: *We have corrected this mistake throughout the manuscript.*

36. Comment:

Line 194: Please add a reference for Eq. 2 and for the coefficient values.

Response: *We have added a reference (Hoehn and Von Gunten, 1989) for the equation and the coefficient.*

Reference:

Hoehn, E. and Von Gunten, H. R.: Radon in groundwater: A tool to assess infiltration from surface waters to aquifers. Water Resources Research. 25(8), 1795-1803, 1989.

37. Comment:

Line 195: this is the first time you indicate that ^{222}Rn is Radon. Should come earlier in my opinion.

Response: *We have indicated that ^{222}Rn is Radon in the Introduction section.*

Results

38. Comment:

Line 262: was the lowest

Response: *We have corrected it as suggested.*

39. Comment:

Line 276: that is recharged

Response: *We have corrected it as suggested.*

40. Comment:

Line 282: were significantly higher

Response: *We have corrected it as suggested.*

41. Comment:

Line 285-286-287: Please consider re-writing

Response: *We have written these sentences as follows:*

"The proportional contributions of river water to riparian S. babylonica trees were significantly higher in 2021 (mean of 23.8% ± 7.8%) than in 2019 (mean of 16.8% ± 4.7%) ($p < 0.05$). Specifically, the most significant difference in monthly RWC to riparian S. babylonica trees between dry 2019 and wet 2021 was up to 19.8% ($p < 0.001$). The maximum value of monthly RWC to S. babylonica trees was significantly higher in wet 2021 (35.2% ± 7.0%) compared with dry 2019 (24.2% ± 3.0%) ($p < 0.05$).

The riparian S. babylonica took up the most river water in July (35.2 ± 7.0%) and November (29.0 ± 5.0%) in 2021, whereas the highest RWC to riparian trees occurred in May (22.2 ± 1.7%) and June (24.2 ± 1.6%) in 2019. The minimum river water uptake for S. babylonica in 2021 was 17.7 ± 2.7% (in September), while riparian trees took up the least water in August 2019 (13.2 ± 1.9%). No significant seasonal-trend of the RWC to riparian trees was observed in both years ($p > 0.05$)."

42. Comment:

Line 293: reference the corresponding figure

Response: *We have corrected as suggested.*

43. <u>Comment:</u>

Line 294: -27.7 is not remarkably larger than -29.7

Response: *The leaf $\delta^{13}C$ value of C3 plants generally ranged from -25.0‰ to -31.0‰. The statistical analysis showed that the leaf $\delta^{13}C$ in 2019 (−27.7 ± 1.0 ‰) was significantly higher than in 2021 (−29.7 ± 0.7 ‰) ($p < 0.05$).*

44. <u>Comment:</u>

Line 295: a significant increase

Response: *We have corrected it as suggested.*

45. <u>Comment:</u>

Line 297: before when (chose one)

Response: *We have deleted "when".*

46. <u>Comment:</u>

Line 303: This statement is dropped without any explanation. I suggest to move it to the discussion and to actually discuss it.

Response: *We have moved the last sentence to the Discussion section. Here is the revised sentence: "The riparian S. babylonica trees likely remained the highest WUE (i.e., utilize lower transpiration water to maximize CO_2 assimilation) as well as the lowest river water uptake proportion under the lowest water table condition (with the WTD of 4 m). In this study, the lower the groundwater level is, the more beneficial it is to optimize the riparian plant-water relations. Therefore, the relationships between the RWC to riparian trees, leaf-level physiological characteristics (e.g., leaf WUE) and hydro-meteorological conditions are critical and helpful for the better protection of the riparian forest while maintaining sustainable river runoff."*

Discussion

47. Comment:

Line 311: what are the interactions? Do you mean exchange of water?

Response: *In this study, there was only one process that the river water recharges the groundwater system along a losing river. We have deleted the confusing words "interactions" and "exchange" as well as clarified this process throughout the manuscript.*

48. Comment:

Line 311: "These contradictions". What contradictions?

Response: *We have deleted the "contradictions" and rewritten this part to make the story clearer. We have further discussed the potential explanations for the small RWC to riparian trees in the 4.2 section (see the response to the comment #1 by the Anonymous reviewer).*

49. Comment:

Line 312: might be due to that the. Please re-write

Response: *We have rewritten this sentence to make it clearer. Here is the revised sentence: "This probably indicated that the river water recharged mobile groundwater quickly but could not completely replace water held tightly in the soil pores (Brooks et al., 2010; Evaristo et al., 2015; Allen et al., 2019)."*

50. Comment:

Line 314: previous studies "showing". There is a word missing here

Response: *We have rewritten this sentence. The revised sentence is as follows: "It was consistent with Sprenger et al. (2019) who found that the lateral seepage of river water or rising water table could briefly saturate riparian soils but not entirely replace/flush immobile waters or isotopically homogenize different water pools."*

51. Comment:

Line 314: You mention previous studies, but cite only one.

Response: *We have deleted "previous studies" and changed this sentence to: "It was consistent with Sprenger et al. (2019) who found that the lateral seepage of river water or rising water table* *could briefly saturate riparian soils but not entirely replace/flush immobile waters or isotopically homogenize different water pools."*

52. Comment:

Line 319: The rising water table stimulated exchanges. Stimulated isn't an appropriate word here. Maybe triggered?

Response: *We have changed "stimulated" to "triggered".*

53. Comment:

Line 319: I don't understand this part of the discussion. It sounds obvious to me that if the water table reach 1.7 m below the surface it will exchange water with the soil layer standing at that same depth and in a larger proportion compared to a situation where the groundwater level is 1m deeper.

Response: *We have deleted this part of the Discussion, and discussed the potential processes that river water recharges riparian deep soil water and groundwater.*

54. Comment:

Line 326: Again, you mentioned previous studies and cite only one.

Response: *We have deleted this sentence.*

55. Comment:

Line 329: a smaller proportion than what?

Response: *We have changed "smaller" to "small".*

56. Comment:

Line 331: "is similar" and "Nearby perennial streams"

Response: *We have corrected it as suggested.*

57. Comment:

Line 334: what is "that" in the sentence?

Response: *We have deleted this sentence and rewritten this section.*

58. Comment:

Line 340: The authors actually did not measure the isotopic signature of the bound water in fine pore and neither the exchange between this water and the river water, so you can't state that it rarely exchanges. What you can do is to speculate and use this argument as an explanation.

Response: *This is a good comment. We have deleted the misleading statement (i.e., it rarely exchanges) and rewritten this part. The revision has been presented in the first paragraph of 4.2 discussion part (see the response to comment #1 by the previous Anonymous reviewer).*

59. Comment:

Line 348: significantly more river water. Actually no, you don't know. A higher proportion maybe, but I would bet that it is the opposite for the amounts.

Response: *We have deleted the "significantly more river water", because we did not measure the amounts of riparian tree transpiration flux. Only a higher proportion of the RWC to riparian trees in 2021 can be determined via the iteration method accompanied with the MixSIAR model. Nevertheless, we added the hydro-meteorological data (including evaporative demand indicated by VPD and net radiation) in this study (section 3.1). These hydro-meteorological data help us to speculate the trends of leaf-level characteristics (e.g., transpiration rate and photosynthetic rate). The details have been specified in the response to the comments #62, #63, and #64.*

60. Comment:

Line 356: The was a balance and coordination…. because obvious differences were found. What you did not find these differences? This entire sentence isn't clear and I don't see the point of it.

Response: *We have deleted this sentence and rewritten the whole section.*

61. Comment:

Line 359: If you say the tree grew more reliance on… you need to compare it with something. Otherwise, you should not use "more". More than what? More than who, another species?

Response: *We have deleted "more" or other comparison when we don't compare it with other thing throughout the manuscript.*

62. <u>Comment:</u>

Line 360 to 370: I don't understand how the authors can actually infer a profligate water use strategy whereas they have no ideas on the water fluxes. They have no transpiration measurements, no evaporative demand measurements. What about the radiation amount? This is a key variable driving water-use efficiency. If the radiation over 2021 growing season was twice less than the radiation in 2019, it is easily imaginable that the photosynthetic rate was substantially impacted and subsequently the WUE.

Response: *This is a good comment. We have added more descriptions of meteorological data in the Results section 3.1 and Figure S1. Extensive discussions about a consumptive water use strategy of riparian trees have been added in this study.*

The average VPD during the observation period was significantly higher in 2019 (1.1 KPa) than in 2021 (0.9 KPa) ($p < 0.05$) (Fig. S1). Nevertheless, no significant difference in average net radiation during the observation period was found between two years ($p > 0.05$) (Fig. S1 a and b).

Higher leaf WUE associated with lower RWC of riparian trees and lower groundwater levels are likely due to that the water stress restricts the stomatal conductance and further reduces transpiration rate of riparian trees. Specifically, dry 2019 was characterized as higher water demand (indicated by higher VPD) and lower water availability compared with wet 2021, but the energy resource (indicated by net radiation) for riparian trees was similar between two years (Figs. S1 and S2). We supposed that the water limitation rather than energy limitation regulated the leaf-level stomatal conductance of riparian S. babylonica trees. The high water demands but low river water availability in dry year probably resulted in stomatal closure of riparian trees to minimize the water loss, which could eventually lead to a decrease of transpiration rate and even photosynthetic rate (Behzad et al., 2022; Fabiani et al., 2021). Aguilos et al. (2018) further found that the water stress would enhance radiation-normalized WUE, because the lack of water availability induced a more reduction in transpiration than photosynthesis. On account of no difference in the average net radiation between dry and wet years, the lower river water availability in dry year probably resulted in an increase of the leaf WUE. It can be inferred that riparian S. babylonica trees took up more river water and probably showed a consumptive water use strategy in wet year compared to dry year. This agreed well with previous studies that the woody plants showed lower leaf WUE and consumptive water-use patterns in rainy season, while they showed higher leaf WUE and *conservative water-use patterns with lower soil water availability in dry season (Behzad et al., 2022; Cao et al., 2020; Horton and Clark, 2001).*

Despite the lack of transpiration flux measurements, we could infer that riparian S. babylonica took up more proportions of river water and probably showed a consumptive water use strategy in wet year compared with dry year based on the plant water uptake patterns, leaf WUE characteristics, and hydro-meteorological data (e.g., evaporative demand, net radiation, soil water content, and water table depth). Nevertheless, the lack of transpiration flux data did not allow us to determine the absolute amount of river water contribution for riparian S. babylonica trees. Further studies need to investigate the root water uptake patterns in combination with the transpiration flux to validate the water use strategy of riparian trees.

63. Comment:

Line 378: In my opinion the argument developed here is misleading. The water table is low, likely because of the high evapotranspiration, which indicates a high transpiration rate, and very likely an even higher photosynthetic rate, leading to a high WUE. Under the same radiation conditions but with a much higher WTD, the WUE would be as high and probably even higher, and not the opposite as suggested by the authors.

Response: *This is a good comment. In this study, the dams along the Chaobai River are used to regulate the river water level especially in flood season, which has a great effect on the river runoff and thus the riparian groundwater level. A total of 51.1 million and 380 million cubic meters of ecological water sources were released to the Chaobai River in 2019 and 2021, respectively. Therefore, the significant difference in water table between dry 2019 and wet 2021 was mainly attributed to the significantly different amount of released ecological water between two years (see Fig. 3 in the response to Comment #126 by previous Anonymous reviewer).*

The high water demands but low river water availability in dry year probably resulted in stomatal closure of riparian trees to minimize the water loss, which could eventually lead to a decrease of transpiration rate and even photosynthetic rate (Behzad et al., 2022; Fabiani et al., 2021). Aguilos et al. (2018) also found that the water stress would enhance radiation-normalized WUE, because the lack of water availability induced a more reduction in transpiration than photosynthesis (see the third paragraph in the response to Comment #62).

64. <u>Comment:</u>

Line 411: That is wrong, the authors did not measure the transpiration so they don't know if a WTD of 4m minimize the plant transpiration.

Response: *We have deleted "the WTD of 4 m minimize the plant transpiration." We mainly discussed the relationship between WTD and the RWC to riparian trees and as well as its corresponding potential explanations. The revised discussion has been shown in the second and third paragraphs of "4.3 The link between RWC/WUE/WTD and its implications" (see the response to Comment #1 by previous Anonymous reviewer).*

Figure

65. <u>Comment:</u>

Fig 1.: I like the figure; it describes the sampling site very well. Please indicate what dotted line represents in right panel (I guess water table level). Also indicate if it represents a measured level or just a schematic representation.

Response: *Thanks for your positive comment. We have added the indication of dotted line on the right panel. The dotted line is a schematic representation of the water table.*

66. <u>Comment:</u>

Fig 3.: The figure indicates an average river water level of 29m. What does it mean exactly? What is the reference, the zero level? Could it be the distance from the river bed? Is it such a deep river? I think most large European rivers displayed a depth of 2 to 5 m. I've never been to this place but 29m deep sounds more like a lake than a river. BTW, how a 29m deep river can lose flow?

Response: *The figure indicates the elevation of river water level. The reference zero level is the sea water level. We have added the elevation of riverbed (26.0 m) as well as riparian ground surface elevation (29.5 m) in the captions. The river water depth is ranging from 1.9 m to 2.9 m in dry 2019, whereas it fluctuated between 1.7 m and 3.3 m in wet 2021.*

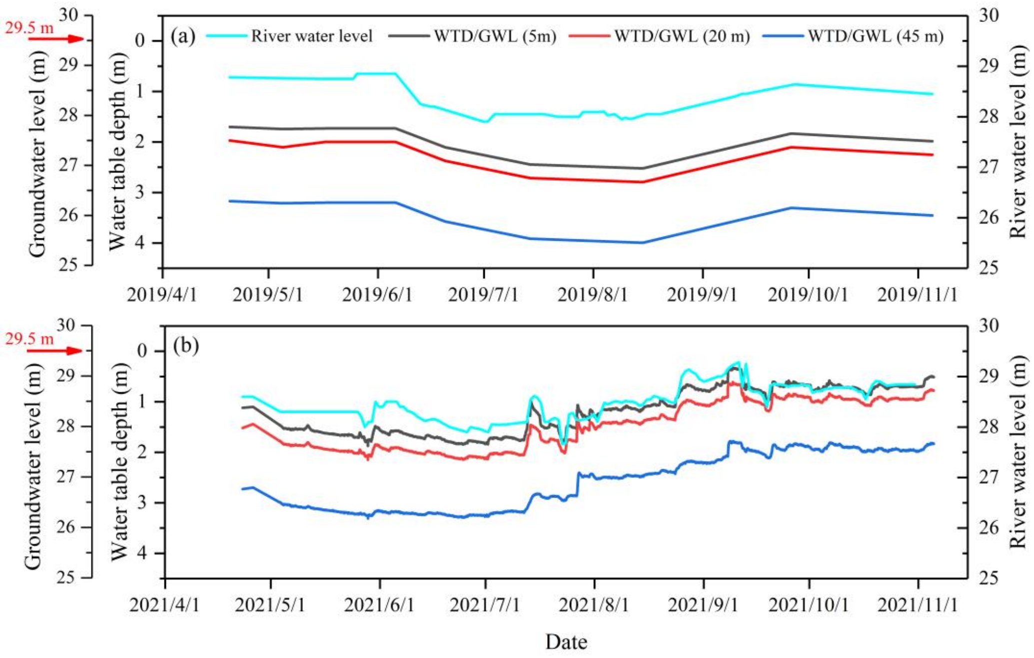

Figure 3: Seasonal variations of the river water level and water table depth (WTD)/groundwater level (GWL) at distances of 5 m, 20 m, and 45 m away from the riverbank during the observation period in 2019 (a) and 2021 (b). The red arrow indicates the riparian ground surface level (29.5 m). The riverbed level is 26 m.

67. Comment:

Fig 4.: The Flowchart and its symbols must be explained in the legend.

Response: *We have added the explanation of flowchart and its symbols in the legend.*

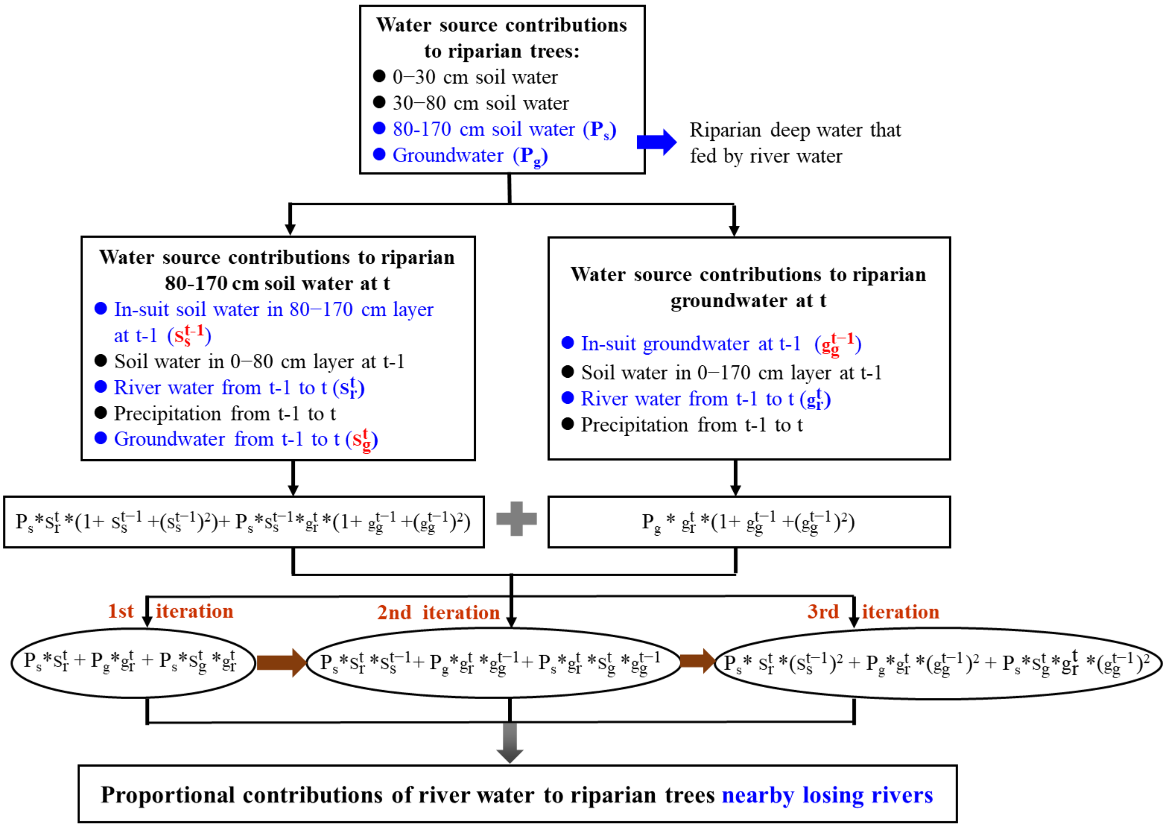

Figure 5: Flowchart for quantifying the proportional contributions of river water to riparian trees. The P_s and P_g represent the contributions of riparian deep soil water in the 80−170 cm layer as well as groundwater to riparian trees, respectively. The s_r^{t-1} and g_r^{t-1} represent the proportional contributions of the old river water (before t-1) to riparian deep soil water in the 80−170 cm layer and groundwater, respectively. The s_s^{t-1}, s_r^t, and s_g^t represent the proportional contributions of in-situ soil water in the 80−170 cm layer at t-1, river water during t-1 to t, and groundwater during t-1 to t for riparian deep soil water in the 80−170 cm layer at t, respectively. The g_g^{t-1} and g_r^t represent the proportional contributions of in-situ groundwater at t-1 and river water from t-1 to t for riparian groundwater at t, respectively.

68. <u>Comment:</u>

Table 2: units of residence time

Response: *We have added the units of residence time in the captions.*

"Table 2: The ^{222}Rn values in river water, background groundwater and riparian groundwater in three plots (D05, D20, and D45), and the average residence time of groundwater (T_{res}, day) in 2021. The background groundwater represents groundwater in aquifers more than 100 m away from the riverbank."