Reviewer 1:

Marshall et al. present a two-year time series of stable isotopes of water in the xylem stream of two boreal forest tree species. The authors pursue three comparisons: 1) shallow vs. deep rooted species, 2) drought vs. non-drought year, and 3) water sources for streams vs. plants. It is this last point, written in terms of the "Two Water Worlds" hypothesis, that is the emphasis of the introduction and discussion.

Synoptic Comments:

This is largely a descriptive longitudinal study, with little formal statistical analysis. Not everything needs formal statistical analysis, but I believe that some opportunities to bring depth are missed. In doing so, one could provide additional insights into mechanism, which I think would be exciting. An example: It would appear that the authors have significant information on precipitation amount/stable isotopes of precipitation. How long does it take for the precipitation signal to propagate into soil, trees, or streamwater when there are distinct summer events?

To address the comment that our study was "largely descriptive," we have taken the reviewer up on their challenge, given as an example, to address the lags in passage of the the isotopic signals through the measured components of the hydrologic system. We began by tracing the drought-breaking event in 2018, which delivered a distinct isotopic signal against low background water concentrations. This yielded a new figure and abit of text describing flux dynamics, which we will include in the revised manuscript. Although we agree it would be interesting to analyze the entire two-year dataset, we have chosen not to do so because it would require a detailed analysis similar to Muesburger et al. (2020), but adding in isotopic data. And this would only address the soils, still not addressing dynamics in the xylem! In short, we think that an assessment of the 2018 drought-breaking pulse is within the scope of the current study, but are reluctant go further. The new analyses have given us opportunities to deal with several of the comments below. The data will be made available to the community and we are eager to support further analyses of this sort in the future.

There have now been many studies of "the two water worlds" hypothesis, which the authors are correct in couching as a heuristic means of proceeding. However, perhaps the turn away from this hypothesis (as noted by the authors themselves on L.56) is because it has reached its utility and there is a need for approaches that elucidate underlying mechanisms. In this sense, I was (personally) more excited by the *continuous* longitudinal nature of the study demonstrating what happens when there is drought and

relief from drought. I wonder if the authors might consider giving this more weight and reframe the introduction in those terms.

We are convinced that the two water worlds hypothesis remains a compelling starting point for this analysis, particularly for readers who are less familiar with the literature in this field, if only because it raises questions about how many water pools are necessary, how they might be measured, and how dynamic they are. We agree that we did not adequately address these broader questions in the introduction and discussion, and will do so in the revision.

Precipitation, soils, trees and streams are never all shown on the same plot; this seems like an opportunity missed, given how few studies have been able to collect all of these simultaneously!

Interesting point, thanks for highlighting this opportunity! We will separate the non-isotopic data into a new Figure 1 and present all of the isotopic data in a new Figure 2, including the xylem and soil water data that are currently in Figs. 2 and 3. We will further present these isotopic data in figure describing the isotopic excursions after the drought breaking rains in 2018.

A primary comparison of this paper is 2017 vs. 2018, which are each given their own panels. An alternative approach would be to have a single panel, with data colored by year to facilitate easier comparison. In addition (and this is would be very useful), recommend that authors shade with transparency the time period of interest (summer) to make interpretation of results easier.

We tried combining the two years on one plot, but found the error bars difficult to see. We thought the error bars were important, especially when the spruce starts to fall toward the pine at the end of the 2018 drought. We will emphasize the error bars more and emphasize the matching y-axes between the panels. We agree to shade the summer period and emphasize that the data series began on different dates.

Introduction

L. 30. I recommend that you modify the first sentence, which neglects to mention the rest of the planet's fauna. Perhaps more importantly, the study is not actually about competing uses of water by vegetation and humans.

Agreed. Will fix.

L. 43. I recommend that you consider that the citation of Brooks et al., while true, neglects the primary proposed hypothesis, which was a temporal offset in the refilling of empty soil water storage (winter) from the timing of its subsequent use.

Will add this mechanism to the description.

L. 44. Similar to the comment above about Brooks et al., the description of Allen et al. is correct, but perhaps an incomplete interpretation. In fact, it would appear that soils hold different amounts of summer precipitation and in drier sites, tend to hold more winter precipitation (Allen et al. in HESS). This (and proposed climatological mechanisms) are proposed in Goldsmith et al. (2022 in GRL) and Floriancic et al. (2025 in Ecohydrology).

Will add a statement to this effect.

L. 58. I recommend that you consider whether recent studies have not discussed water sources in terms of "water worlds" because the framework may not have utility in advancing our understanding of the processes that underly the observations.

We were perhaps overly careful. Will now strengthen these statements in the revision

Methods

L. 80. Recommend that you provide the difference in (e.g.) summer rainfall between 2017 and 2018 as a total and as percentage of the annual. Otherwise, it is hard to contextualize the severity of the drought from Figure 1 alone, wherein there does seem to be episodic rainfall.

We agree that Fig. 1 is not very compelling on its own. There are now several papers describing the drought at this site and will use them to inspire a better way to provide context.

Figure 1. Recommend you add more dates to x-axis, particularly top panel, where it would be nice to see times more closely. Additionally, consider merging 2017 and 2018 into one panel with different colors, as that is a primary comparison.

Agreed.

Figure 1. Recommend reconsidering the red line. More useful than delineating a calendar year would be to delineate summer months through gray shading.

Agreed.

L. 84. Recommend you delineate how long sensors were in place before measurements began.

Agreed.

L. 105. Recommend that you specify that all isotopes are provided per mille relative to V-SMOW.

Agreed.

L. 109. Recommend that you offer additional details on sample handling for water samples. I assume sealed in glass/plastic vials and stored in a cool setting until analysis.

Agreed.

L.111. The study is actually all the stronger for at least having some measure of the soil water. It's striking that it takes halfway through the methods to read this – it's a much more complete picture with this in place and it should be mentioned in the introduction.

Agreed.

L. 113. Recommend that you compare how the depths of the soil water sampling match with what is known about the depths of soil water use by the two contrasting species.

Agreed.

L. 116. How does the isotopic value of water vapor in soil compare to what we would expect be available to plants. Or, in other terms, water that is more or less mobile? Recommend that the authors comment.

This question has been answered by others who use soil equilibration methods. Will explain and cite.

L. 125. Since SOI is a comparison with precipitation and xylem water reflects a potentially evaporated source water signal (soil), many studies compensate for this evaporation (e.g., see original work by Allen et al. 2019 in HESS). Recommend pursuing this approach or at least confirming that it does not change your interpretation, especially in 2018 when you would expect drought to have an impact.

We agree that we should mention this important point. We will explain that the approach to the precipitation isotope value in the spruce xylem water after the rains in 2018 suggests that at least in that event, there was not much evaporation. Will also cite Allen et al.'s observation that the canopy interception does not have much effect. This could be quite different if the events were small and infrequent.

L. 130. Recommend that you include details on how the precipitation isotope data were collected. What device? Are the isotope ratios amount weighted? How often were samples collected? How were they stored?

Will provide these details.

Results and Discussion

L. 136. Recommend quantifying precipitation amounts and providing comparisons.

L. 139. While this is almost certainly true, it's so true as to be obvious. On the other hand, is physical surface evaporation a consideration in this ecosystem? Recommend revising this sentence.

L. 142. It should be relatively easy to calculate a minimum event size needed to percolate to the different sensor depths. Recommend that the authors consider as much in order to bring depth of understanding to this analysis.

This is actually a bit tricky with the canopy interception and the water absorption in the forest floor, however it has been done before, and near the current study site. We will generate an estimate and compare it to the time delay in the soil isotope shift, while noting that the soil may lag because of limited hydraulic conductivity.

L. 153-154. This number "(-10.00, SE 0.05‰)" and similar numbers are hard to interpret. Recommend specifying if it's an annual mean and using plus/minus per typical convention, then specifying that it is standard error.

Will do.

L. Figure 2. I've always been a little uneasy with the idea of calling it sap and in fact, this is the only place where it is referred to as such. Recommend "Xylem water" or "Xylem water vapor" for consistency with paper. Recommend indicating per mille after noting isotope ratios of particular events, for sake of clarity.

Agreed.

L. Figure 3. Are these continuous measurements? If not (or if average in some way), recommend adding points on the lines to clarify sampling interval.

Will do. They are daily averages.

L. 184. Why refer to it as "the xylem water used in transpiration" here and not elsewhere? This confused me; recommend you clarify if possible.

Can instead emphasize that xylem water goes to transpiration in the introduction and delete reference to transpiration here..

L. 188. To me, it would appear that the trees had lower SOI values at the start of the growing season in 2018 in general, as well as a change given drought. Recommend you consider commenting.

Can emphasize here that the data began much earlier in the year in 2018 than 2017.

L. Figure 4. Here the seasonal origin index is >1 in late 2018, indicating that the xylem water is in excess of the summerP isotope value. This would be an argument for providing more information on the calculation of the precipitation isotope sine curve.

Agreed.

L. Figure 4. What is the SOI of soil water? Recommend adding this to the figure.

Agreed.

L. 214. More probably, an SOI near zero is an almost infinite possible mix of spring, summer, fall and winter waters.

Right. Will modify.

Relevant recent literature:

Floriancic et al. (2024) Isotopic evidence for seasonal water sources in tree xylem and forest soils

Kinzinger et al. (2025) Continuous In-Situ Water Stable Isotopes Reveal Rapid Changes in Root Water Uptake by Fagus sylvatica During Severe Drought

Brighenti et al. (2024) Snowmelt and subsurface heterogeneity control tree water sources in a subalpine forest

Sprenger et al. (2025) Opportunistic short-term water uptake dynamics by subalpine trees observed via in situ water isotope measurements

Thanks for these excellent suggestions! We will certainly cite some, at least.