Dear Editor,

We are submitting a revised version of the manuscript "Vegetation Greening Weakened the Capacity of Water Supply to China's South-North Water Diversion Project" for your consideration in publishing in HESS.

We have addressed all concerns of the reviewer and associate editor. Key revisions include:

1) **We substantially stressed the benefits of forest service associated with vegetation greening against the potential strong water consumption revealed by our study in Abstract, Discussion and Conclusion. The Discussion section 4.1 were expanded to discuss the atmospheric moisture transport and the precipitation recycle effects on our results.**
2) **To avoid confusion and better reflect our finding, we adjusted our previous title "***Vegetation Greening* ***Significantly Reduced*** *the Capacity of Water Supply to China's South-North Water Diversion Project***" to "***Vegetation Greening* ***Weakened*** *the Capacity of Water Supply to China's South-North Water Diversion Project***"**
3) **We addressed all minor comments of the reviewer and carefully re-edited this manuscript on presentation and grammar.**

Please see our point-to-point responses to the reviewers below. We hope that the revision meets the high standard of HESS.

Sincerely,

Corresponding authors

To Reviewer #1,

Comments:

The authors have invested quite some effort to address the reviewer comments. As a result, the revised manuscript has improved, in particular with respect to the detail provided in the description of the experiment and the discussion of the limitations. I commend the authors for that.

Response: We appreciate your recognition of our previous revision very much. Your insightful comments and suggestions helped us a lot on improving the manuscript. Please find our point-by-point response below.

However, this being such an important topic, it is crucial to realize that the manuscript has embarked on the challenging necessity to walk on a very thin line between the immediate and direct services of water yield and the larger-perspective services related to a changing climate. As such, it is important that the manuscript provides a balanced view of the potential trade-offs involved. Although the authors promised to do so in their author responses, I still feel that the message still heavily leans towards the importance of water

yield and that it is not yet sufficiently balanced towards other services. In particular, in the abstract and the introduction, very little to no specific mention is made of the potential of afforestation for example to increase CO2 sequestration and to thus provide carbon sinks. Similarly, the importance and relevance of forests as atmospheric moisture source that sustains downwind precipitation as well as their role for (evaporation) cooling have not yet been given sufficient weight neither in the introduction nor in the discussion (e.g. section 4.2) and conclusion sections of the manuscript. While I appreciate the authors efforts to explicitly mention trade-offs, more specific detail is needed to avoid a very one-dimensional message to the reader, which may have very wide-reaching consequences. I thus strongly encourage the author to invest some more effort to provide a really balanced message.

Response: Done as suggested. We fully realize the potential misunderstanding of ecosystem services provided by reforestation against the water consumption revealed by our study. In this revised version, we added emphasis on the ecosystem goods and services that vegetation greening can bring both in the Abstract the Conclusions sections, and further discussed the potential feedbacks among vegetation, evapotranspiration, and precipitation in the Discussion.

Specifically, to stress the benefit of forest service in the Abstract (lines 26-28), we added "Although vegetation greening can bring enormous ecosystem goods and services (e.g., carbon sequestration & water quality improvement), it could aggravate the severity of hydrological drought. Our analysis indicated that vegetation greening in UHRB reduced about a quarter of water yield on average during drought periods.".

To discuss the potential feedback of vegetation to precipitation, we added a new paragraph in Section 4.1 (lines 345-361): "Although vegetation greening had negative effects on WY at the regional scale as we found in the UHRB, some previous studies indicated that vegetation greening could increase WY at larger spatial scales. Enhanced ET from vegetation could moisten the atmosphere, thus drive P to increase. On the other hand, Makarieva et al., (2007) argued that increases in ET could drive the transport of water vapor across continental space via changing atmospheric pressure dynamics. Therefore, vegetation greening in the UHRB may also potentially increase P via increasing atmospheric vapor. However, the amount of recycled P is strongly dependent on the watershed area, with larger geographical expanses having greater potential for recycling. At the regional scale, 87% of the atmosphere moisture through enhanced ET in nine large basins around the world are not likely to recycle back as P, but transport to other regions. The proportion of recycled P in the UHRB would be lower due to its smaller extent. Tuinenburg et al., (2020) found that moisture from ocean contributes approximately 67% of P in the Yangtze River Basin (where the UHRB located). In addition, the atmosphere moisture through enhanced ET in the upwind areas was possible to transport to the downwind, thus increase P. The upwind areas of the UHRB, Southeast China, also experienced vegetation greening simultaneously, which may lead to P

increase in the UHRB. A modelling study found that vegetation greening only induced an P increase of 1.5% per decade in the Yangtze River Basin from 1982 to 2011. Given that no particular trend in annual P in the UHRB was observed (Figure A1b), the effects of local and upwind greening on P may be limited during the study period. However, such complex feedbacks among vegetation, evaporation and precipitation are worth investigating in the future.”.

To strengthen the trade-off among ecosystem goods and services induced by greening, we expanded expressions in Section 4.2.

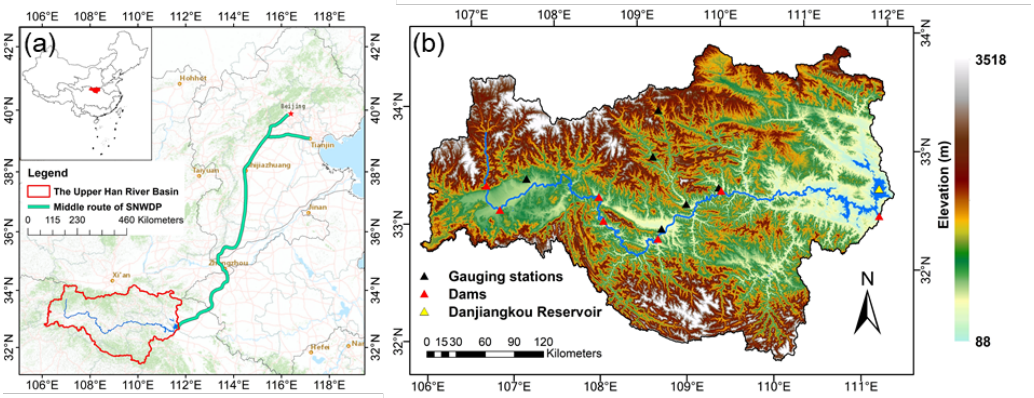
In the conclusion, we further reflect forest service by adding “Despite the enormous ecosystem goods and services provided by forest (e.g., carbon sequestration, water quality improvement, and regulation of air temperature and moisture), our study suggests that navigating the trade-off of water supply with these benefits in source watersheds is an important consideration in large water diversion projects.” in line 457-460.

Given the potential feedbacks among vegetation, climate and human management, to avoid confusion and better reflect our finding, we changed our previous title “Vegetation Greening Significantly Reduced the Capacity of Water Supply to China’s South-North Water Diversion Project” to be a moderate one: “Vegetation Greening Weakened the Capacity of Water Supply to China’s South-North Water Diversion Project”. Overall, we believe that the study now delivers a clear message about the hydrological effect of vegetation greening in the broader context of benefits that forests provide.

Technical comments:

- the green triangle for the Danjiangkou Reservoir in Figure 1 cannot be seen. In general: please avoid using red and green colours next to each other in figures as >10% of your readers may be red-green colour blind.

Response: Done as suggested. The triangle was changed as yellow.



- it will be very helpful for the reader to actually show the confidence intervals in the figures of the regression lines and/or trends, instead of only providing the numbers. For example in Figure 5, the reader can easily miss that the slope in the trend of the water yield is -2.9+/-10(!!!). Please also provide uncertainty intervals for the modeled water yield (Figure 4)

Response: The benefits of adding the confidence intervals on the regression lines come with detrimental visual effects. It will make some figures (4a, 5c) messy, and sometimes nearly impossible to follow. We added the confidence interval in Figure 3a, 5b, 6a, but did not in other figures.

To Reviewer #2,

With pleasure I read the revised manuscript by Zhang et al. on the effects of vegetation greening on water yield in the Upper Han River Basin. I was one of the reviewers of the first version of the manuscripts. The authors well answered to the questions and comments that were raised by the reviewers and incorporated the suggestions. The extra information in the methods section, and the short evaluation of the trend in the measured streamflow greatly increased the clarity of the study, and took away the questions and 'concerns' I had after reading the first version. Also the broader discussions of the effect of forest planting and feedbacks have added value to the manuscript.

Response: We appreciate your recognition of our revision. Your comments and suggestions helped a lot on improving the manuscript.

I have a few small suggestions that the authors could consider:

L203, "Here, the monthly drought index was calculated as the percentages of monthly WY to the mean WY of the same month during 2001-2018"? I assume this is calculated based on the modeled streamflow. Could you clarify this in the text?

Response: Clarified as "Here, the monthly drought index was calculated as the percentages of monthly WY to the mean WY of the same month during 2001-2018 based on simulated WY"

Figure 5: For clarity, I suggest to add to the caption of figure 5 that this figure contains the modeled results. For example: "Figure 5: modeled spatial and temporal variability of water yield in the Upper Han River Basin"

Response: Revised.

Figure 6: Since the change point detection was removed, you could remove the distinct orange coloring of WY/P ratio before 2003.

Response: Revised.