

Interactive comment on “Downstream ecosystem responses to middle reach regulation of river discharge in the Heihe River Basin, China” by Y. Zhao et al.

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Received and published: 5 September 2016

Prof. Xin Li's comments 1: Change of cropland has a very significant impact on the hydrological cycle in the Ejina oasis area and might lead to some policy change on water diversion in upstream. I would suggest that the authors to provide an in-depth analysis of the impact of cropland expansion on water resource management, not only at the downstream area but also on the whole river basin. For example, $0.1-0.2 \times 10^9 \text{ m}^3 \text{ yr}^{-1}$ of water might have been used by cropland. According to the water diversion agreement (EWDP) of the HRB, all the cropland in the downstream area should be converted to natural vegetation. Therefore, cropland reclamation in the downstream area is somehow illegal. If the cropland can be appropriately managed, I believe the

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ecosystem restoration in the downstream area of the HRB will be more significant. I would suggest the authors to expand the discussion in the first paragraph of Page 13.

Authors' response: We fully agree with Prof. Li's concern about the impacts of cropland expansion on water cycle in the Ejina Oasis. Prof. Li's comments of "appropriately manage local cropland could promote downstream restoration" supported our argument of "the agricultural development stimulated by the additional water resource might have obstructed further ecosystem recovery because large amounts of water have been consumed by the agriculture sector". However, given that the objective of this article was to understand the downstream ecosystem responses to middle reach regulation of river discharge, we analyzed the cropland distribution in the downstream to help understanding the competition relationship between crop and natural vegetation on water use. Therefore, we didn't expand our study into the crop land in the middle stream of HRB. As a matter of fact, the impact of middle stream agricultural development on the downstream ecosystem has been embedded in the streamflow variations flowing into the down stream, since agriculture in the middle stream of HRB is the major water consumer.

Prof. Xin Li's comments 2: Also for the cropland, I would suggest the authors to compare their mapping results with that by Hu et al., 2015 (Hu, X. L., L. Lu, X. Li, J. H. Wang, and X. G. Lu. 2015. Ejina Oasis land use and vegetation change between 2000 and 2011: the role of the Ecological Water Diversion Project. *Energies* 8:7040-7057). An evaluation of the accuracy is suggested to be added to Section 2.4.2.

Authors' response: We appreciate Prof. Li's suggestion and compared our results with Hu's results in 2000 and 2011 (Hu et al., 2015). Our results show high consistency with Hu's results as displayed in Fig.1 (our results in green and Hu's results in red). We will revise the relevant part of our manuscript with the comparison results from this new dataset. An evaluation of the accuracy would be added to Section 2.4.2.

Accordingly, we will also revise the "Acknowledgement" section to deliver our thanks to

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Dr Xiaoli Hu for sharing us with her land use and land cover maps in 2000 and 2011. The reference list will be updated as well.

Prof. Xin Li's comments 3: P7, second paragraph. Actually, some FVC datasets for the Heihe River Basin have been produced (1km: <http://westdc.westgis.ac.cn/data/21d993d3-841a-4d04-9647-82c21601a739> and 30m: <http://westdc.westgis.ac.cn/data/aa9f7e76-363f-4e21-b44c-adf50dd96b0f>). I would suggest the authors to use the datasets in their analysis or validation of FVC products.

Authors' response: Once again, we appreciate that Prof. Li provided data sources for us to improve our results quality. We related our 2014 FVC estimation with the field data collected in 2014 in (<http://westdc.westgis.ac.cn/data/c008ca1d-dd30-44cc-876d-9298dd07982d>) and found that, the FVC values derived from Landsat images presented relatively high accuracy as indicated in the following figure (Fig.2). We will revise the relevant part of our manuscript with the comparison results from this new dataset accordingly. A map showing location of the field sampling points as well as some details on sampling methods will be also added in a supplementary document.

Reference : Observation Dataset of fractional vegetation cover by digital camera in the lower reaches of the Heihe River Basin. Cold and Arid Regions Environmental and Engineering Research Institute, Chinese Academy of Sciences. 2015. 10.3972/hiwater.271.2015.db)

Prof. Xin Li's specific comments: (see paragraphs (in bold) listed below)

P2, L 28, "since the establishment of new China government in 1949, the Basin has experienced water and ecological stress" ->"since the quick population growth in 1940s, the HRB has experienced water and ecological stress".

Authors' response: We agree and will modify the sentence as suggested.

P3, L13-14, "To our knowledge, this is the first attempt to apply high-resolution images

and long term datasets in Ejina Oasis" -> "To our knowledge, this is the first attempt to apply long term high-resolution remote sensing derived land cover datasets in Ejina Oasis".

Authors' response: we agree and will update the sentence accordingly.

P4, L22, add a reference. Li, X., Z. T. Nan, G. D. Cheng, Y. J. Ding, L. Z. Wu, L.X. Wang, J. Wang, Y. H. Ran, H. X. Li, X. D. Pan, and Z. M. Zhu. 2011. Toward an improved data stewardship and service for environmental and ecological science data in west China. *International Journal of Digital Earth* 4:347-359.

Authors' response: We will update our reference list.

P12, L11, "data not presented here". Why?

Authors' response: the description of "Observations in this area (data not presented here) have found that the annual average groundwater depth alongside the river (< 300 m) was around 2 m, which increased to more than 3.5 m in remote regions (> 4300 m away from river channels)." was derived from the long term groundwater level observation in downstream HRB, which was also archived in the WestDC database. We will add a table or a figure showing the observed groundwater variations when we revise our manuscript to provide readers with more detailed information.

References

Lu, L., X. Li, and G. D. Cheng. 2003. Landscape evolution in the middle Heihe River Basin of northwest China during the last decade. *Journal of Arid Environments* 53:395-408.

Wang, G. X., J. Q. Liu, J. Kubota, L. Chen, G. AF Wang, J. Liu, J. Kubota, and L. Chen. 2007. Effects of land-use changes on hydrological processes in the middle basin of the Heihe River, northwest China. *Hydrological Processes* 21:1370-1382.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., doi:10.5194/hess-2016-268, 2016.

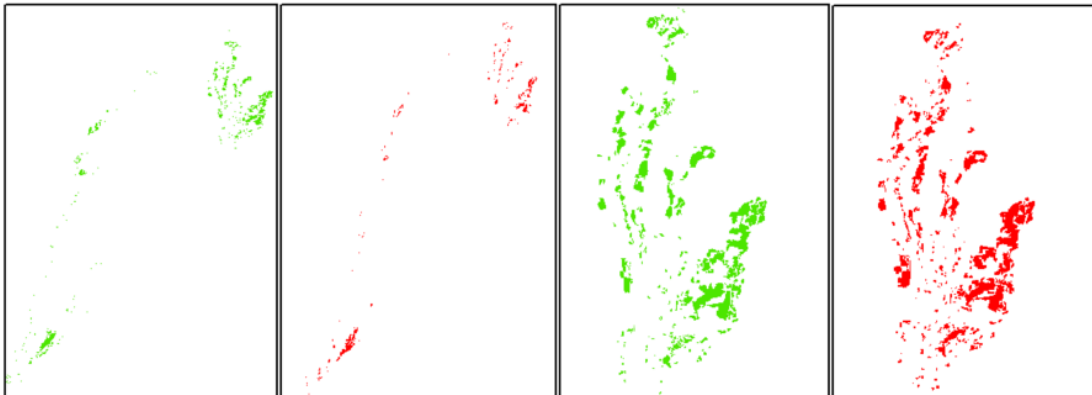


Fig. 1. Comparison of cropland distribution maps in 2011 (left to right, our overall results, Hu's overall results, our results in major cropping region and Hu's results in major cropping area)

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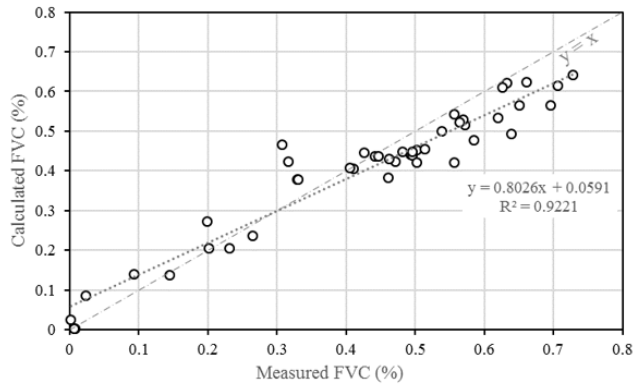


Fig. 2. FVC validation with field measurements (right panel indicated location of plots)

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