

## ***Interactive comment on “Evolution of Vegetation System in Heihe River Basin in the last 2000 years” by Shoubo Li et al.***

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Referee #2's General comments The manuscript used Remote sensing data and historical research results to studied vegetation change in Heihe River basin in past 2000 years. The topic of the manuscript is very creative as there aren't many researches on historical vegetation change, especially on natural vegetation. The results of historical natural vegetation study is useful, however there are too many uncertainties to study. The authors' methods were not very complicated but proved to be very effective. The results of the manuscript were also very interesting.

Response: Thanks for the reviewer' positive comments on our study.

Referee #2's Specific comments:

1) Page 3. Legends should be added to Figure 3.

Response: Agreed. We will update Figure 3 with legends in the revised manuscript.

2) Page 5. Did you considered other data source instead of Landsat images? Landsat images are not very useful to study interannual variability. In the article, MODIS data was used to rectify Landsat. It is acceptable, however, it also increased error of the results.

Response: Thanks for the comment. Although there are other satellite images available such as MODIS and AVHRR, we would like to argue that Landsat image is one of the most suitable sources for long term studies as it has the longest archived data available and with relative stable qualities. In addition, we set criteria in selecting the images for example it should be acquired in the same period of each year (growing season) and there was low cloud contamination during the acquisition period. In rectifying Landsat with MODIS, it might result in certain uncertainties since there are differences in the amplitudes of Landsat and MODIS signals captured at different spatial scales. However, the phenology cycles of vegetation obtained by the two datasets should be similar. Therefore, we determined the thresholds using the rectified images rather than the original ones acquired on different dates.

3) Page 7. Need more explanation for the data you quoted. Response: Agreed. We will revise this section to clearly demonstrate the data we quoted and the data we reconstructed, respectively. Specifically, we will list the data we extracted from previous studies (e.g. historical vegetation distributions, stream flow and precipitations etc.) and give necessary introductions and citations. We will also give comprehensive descriptions about the reconstructed datasets (biomass) by detailing the hypothesis and calculations.

4) Page 14. Figure 7 is not very clear to me. Response: Thanks. We will include more details in the caption to clearly provide information about the scatter diagram. We will increase the font size and resolution of the figure in the revised manuscript as well.

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5) In general view, natural vegetation and crops compete of water resources. Can you explain why in your results the natural vegetation and crops increase or decrease synchronously?

Response: Thanks for the comment. We agreed that in general view natural vegetation and crops compete of water resources when the amount of total water resources is fixed. However when water resources available are increased, the competition could be weakened or even disappear for a certain period. For example, in our study area, for the recent decades, increasing streamflow caused by the elevated temperature and increased snow melting in the upstream has caused the increase of total water resources which might be the reason for the overall growth of both natural and crop vegetation. However, the competition between natural vegetation and crop was observed as indicated in Figure 4. For instance, crop area for the period from Yuan Dynasty to RC showed constant increase, whereas natural vegetation distributions decreased for the same period. In 1998 - 2003 decrease in natural vegetation were observed as well. As we argued in the Discussion section, further research should be conducted to clarify this phenomenon for the mechanistic perspective.

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