

Earth Syst. Dynam. Discuss., author comment AC1
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Reply on RC1

Bojie Fu et al.

Author comment on "Coupling human and natural systems for sustainability: experience from China's Loess Plateau" by Bojie Fu et al., Earth Syst. Dynam. Discuss.,
<https://doi.org/10.5194/esd-2022-1-AC1>, 2022

Thank you for your valuable suggestions and the time that you have spent reviewing our manuscript. We will follow all your suggestions in our revision. Below are the reviewer's previous comments, followed by our responses.

Sincerely,

Bojie Fu (on behalf of the author team)

Reviewer #1 (General comments):

This paper provides a comprehensive overview of the conceptual cascade framework of "Pattern-Process-Service- Sustainability", and also provides a concrete example on the application of this framework at the Loess Plateau in China. This region has been subject to major vegetation restoration activities during several decades, and the impacts of these activities have been extensively studied by different methodologies. This accumulated research provides an excellent example of the value of systematic and integrated studies for solving socio-ecological problems on the very large scale.

I do not have any major comments on the methodologies or content, because the study mainly reviews results of already published material in well-known journals and puts them into the conceptual framework. The authors clearly have a very good knowledge about the recent literature in the field, and the context of the research.

[Response] We thank you for your positive comment.

Specific comments:

[Reviewer #1 Comment 1] lines 66-58 I would suggest to use present tense (i.e. "is introduced" and "is systematically illustrated", because this refers to aims of the present paper. I would suggest checking this also in other places (e.g. Conclusions).

[Response] Thank you for your suggestion. Following your suggestion, we will revise the sentence as: "This paper starts with a detailed introduction of the proposed framework and its components, then systematically illustrates the use of this framework to study the

dynamics of CHANSs and support decision making for the promotion of sustainability through a review of research experiences in China's Loess Plateau (LP).". In addition, we will carefully check the tense of the whole manuscript.

[Reviewer #1 Comment 2] Section 3 China's Loess Plateau: I would propose to include a table giving some more details about the area, such as T, soil and vegetation types, population, etc.

[Response] According to your suggestion, we will add a table to give more details about the Loess Plateau, including annual mean temperature, precipitation, and potential evapotranspiration, soil and vegetation types, geomorphology, population, and some other socioeconomic characteristics.

[Reviewer #1 Comment 3] lines 175-180 Is there a gradient in precipitation that would affect this NPP limit given and has there been any changes in precipitation during this period? Is climate change likely to cause any further water stress in this region that could affect these conclusions? These topics would require a little more discussion here.

[Response] Thank you for your comment. There is a precipitation gradient from the south-east to the north-west in the LP, and the precipitation of the LP showed no significant change from 2000 to 2015 (Wu et al., 2019). In Feng et al.'s study, the estimated NPP threshold is the annual NPP at the LP scale, and therefore the effect of different precipitation gradients on the permissible NPP threshold is not considered (Feng et al., 2016). We will add more discussions on future climate change and its effects on this permissible NPP limit: "Future climate change will affect this permissible NPP threshold. Considering the maximum, median, and minimum scenarios of precipitation change and future changes in plant water-use efficiency, permissible NPP by 2050 is $578 \pm 48 \text{ g C m}^{-2} \text{ yr}^{-1}$, $473 \pm 41 \text{ g C m}^{-2} \text{ yr}^{-1}$, and $309 \pm 29 \text{ g C m}^{-2} \text{ yr}^{-1}$, respectively (Feng et al., 2016)."

References:

Feng, X., Fu, B., Piao, S., Wang, S., Ciais, P., Zeng, Z., Lü, Y., Zeng, Y., Li, Y., Jiang, X., and Wu, B.: Revegetation in China's Loess Plateau is approaching sustainable water resource limits, *Nature Climate Change*, 6, 1019-1022, 10.1038/nclimate3092, 2016.

Wu, X., Wang, S., Fu, B., Feng, X., and Chen, Y.: Socio-ecological changes on the Loess Plateau of China after Grain to Green Program, *Science of The Total Environment*, 678, 565-573, 10.1016/j.scitotenv.2019.05.022, 2019.

[Reviewer #1 Comment 4] lines 220-228 There is some repetition of text here vs. the Introduction, please check.

[Response] Thank you for your reminding. We will revise the beginning of Section 4.2 as: "By coupling patterns and processes, researchers found that the ecological restoration program has altered the soil erosion and water-carbon processes and flow-sediment relationships in the LP (Feng et al., 2016; Wang et al., 2016). As ecological processes underpin the delivery of ESs, changes in these natural processes in the LP will affect ESs that local residents depend on (Fu et al., 2013). Linking ecological processes to ESs can help understand the complex relationships among ESs and support optimized ecosystem management measures (e.g., minimize trade-offs and maximize synergies) and sustainability of CHANSs (Fu et al., 2013). Regarding this aspect, a large number of studies about land use and land cover change, ES assessments, and their trade-off and synergy analysis have been conducted in the LP over the past two decades."

[Reviewer #1 Comment 5] line 283 Use colon (:) after "Enhancing water security" or subheading here. The same goes for the other subsections ("Enhancing food security" and

so on).

[Response] Following your suggestion, we will use colon (:) after the four subtitles.

[Reviewer #1 Comment 6] line 403-406 Future directions: I would assume that climate change impacts on NPP and water yield would be a key topic for future research?

[Response] Thank you for your suggestion. The future directions we proposed in Section 5 "Future directions of the Pattern-Process-Service-Sustainability paradigm" are oriented to the framework and CHANS studies, and therefore they are comparatively macroscopic. The future research direction "Climate change impacts on NPP and water yield" is a very valuable and specific research topic in the LP. Therefore, we will add this in Section 4.3 "Social-ecological sustainability": "Besides, it is necessary to consider the impact of climate change on NPP and water yield to meet future challenges of water shortage."

[Reviewer #1 Comment 7] line 550 This reference seems to be incomplete: Ouyang, Z., H, Z., Y, X., S, P., J, L., W, X., Q, W., L, Z., Y, X., and E, R.: Improvements.....

[Response] We will revise this reference as "Ouyang, Z., Zheng, H., Xiao, Y., Polasky, S., Liu, J., Xu, W., Wang, Q., Zhang, L., Xiao, Y., Rao, E., Jiang, L., Lu, F., Wang, X., Yang, G., Gong, S., Wu, B., Zeng, Y., Yang, W., and Daily, G. C.: Improvements in ecosystem services from investments in natural capital, *Science*, 352, 1455-1459, doi:10.1126/science.aaf2295, 2016."

In conclusion, I think this is a valuable paper that deserves to be published after making these rather minor additions/changes suggested.

[Response] We thank you for your positive comments and the time that you have spent reviewing our manuscript.