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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Reconstructing the natural hydrology of the San Francisco Bay-Delta watershed" *by* P. Fox et al.

Anonymous Referee #2

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The paper by P. Fox et al is a good contribution to the Special Issue. In the spirit of use-inspired socio-hydrologic science, it has profound societal implications.

At the heart of the paper is the management of the San Francisco Bay Delta. Declines in fish species have led to calls to restore "unimpaired flows", flows that would occur if current dams and canals in the upper catchment did not exist. The authors argue that this is not an appropriate standard. The unimpaired standard essentially assumes that all water currently being used for human uses would have been available to the Bay Delta. In other words, natural vegetation on the Central Valley floor did not transpire any water or significantly affect outflows into the Bay Delta.

The authors provide evidence that this claim is unreasonable. Prior to the existence

of humans, the valley floor was covered with a variety of marshes, vernal pools that transpired considerable amounts of water, about 54-72I find the basic logic of this paper to be sound and I also think it is presented in a logical and clear manner, but it would greatly help if the results were also displayed more clearly.

- It would help if Figure 1 also showed where the flow into the Bay Delta where the "unimpaired flow" standard is being applied.
- While the argument is easy to follow, the results could be presented in a clearer manner. The endless tables get tedious. Please include one graph comparing the three flows under Natural (Case I), Current and Unimpaired. This is the main point of the paper but not presented clearly anywhere.
- It is really striking how different the original and current land use of the region is in Figure 4 and Figure 5 – but it is difficult to compare because the classification systems are totally different. Would it be possible to use a single classification system for Historical (natural) and Current land use and show them next to each other instead of two separate graphs? If this is not possible, another option would be to show the natural and current ET maps next to each other (using a single legend).
- While the analysis in this paper is simple, the implications are quite far reaching and therefore it's necessary to be sure that the core components are correct. The argument is contingent whether the base map used (the CSU Chico map) is correct and whether the correct ET values have been chosen for different vegetation types. Would it be possible to provide evidence that the CSU map is consistent with other estimates of land use particularly for the high ET species (wetlands and perennial grasslands)? E.g. a single table in an Appendix with the CSU area compared to area estimates by other scholars for each species.

- Just because annual natural flows are in the range of current flows, it doesn't mean that human alterations have not impacted the delta in terms of the fluctuations and timings of flows. It's possible that humans have either increased or decreased inter-annual and intra-annual variability (will need dam operation data for this). I think presenting monthly analyses as a graph may help – considering that the analyses was actually done at a sub-annual scale.
- The effect of GW is clearly important and missing as the authors acknowledge. If GW depletion has occurred should this be considered a net addition of "water supply" into the basin just as inter-basin transfers from the Trinity River are considered inputs?
- I am assuming urban uses are considered to be net of return sewage flows – this isn't clearly specified anywhere.
- The paper ends with a call for more research, which is fine but not sure that will help the immediate problem of declining fish. I am reasonably convinced by the author's central argument that "unimpaired flows" are an inappropriate standard to manage the Bay Delta and "natural flows" are a better standard. However, it is an indisputable fact that species in the Bay Delta are declining. Early on, the authors suggest the causes may lie elsewhere with sedimentation, nutrients, flow timing, temperature changes etc.). Thus, the analysis does not help actually solve the Bay Delta problem and sadly makes it much more complicated. There is a tendency among agencies to fixate on a single parameter because it is so much easier to track and communicate to the public and policy makers – but sometimes it's simply wrong. It would help sharpen the paper if this point is made more clearly at the end and also offer some alternatives if the objective is to save endangered fish species.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 12, 3847, 2015.