

## ***Interactive comment on “HESS Opinions: The Myth of Groundwater Sustainability in Asia” by Franklin W. Schwartz et al.***

**Franklin W. Schwartz et al.**

schwartz.11@osu.edu

Received and published: 20 October 2019

We are appreciative of the constructive comments on the paper from all three reviewers. Following here is our detailed response to comments of Reviewer #2. We have considered Reviewer #2's thoughtful comments and made appropriate changes.

Reviewer #2

1. This is an interesting opinion paper on a well-known and significant topic. I enjoyed reading it, especially the review on the case studies and the main problems hampering the effective and sustainable management of groundwater resources. To my best knowledge, the “myth” of groundwater sustainability, and groundwater management in general, belong to many countries, even “advanced” ones, not only Asian.

[Printer-friendly version](#)

[Discussion paper](#)



(response) We appreciate Rev#1's kind comments here. We added the following point that groundwater sustainability belongs to many countries to the Introduction. "For many of these countries and even others outside of Asia, groundwater sustainability is essentially just a myth."

2. The paper is made of two parts: illustration of selected examples and some proposals for a "pragmatic research agenda". The first part is quite good and convincing, although the main conclusions are unfortunately rather obvious and well known nowadays. The collection of cases is not a comprehensive review of groundwater management casein Asia, and it is not meant to be that, but it delivers the message; still, the socio-political conditions are much different among sites such that a comparison is not possible. Perhaps the main focus of the hurdles is on the technical issues, less on the sociopolitical constraints that in many cases lead the process.

(response) We agree with Rev#2 that the focus of the original draft was on technical issues. Yet, as Reviewer #2 indicates, "the socio-political constraints" do indeed lead the process. Given that Rev #1 raised this same issue, we recognize that our "hints" about the importance of this aspect were insufficient.

We addressed this weakness of the paper by adding ~1 page in the introduction, discussing the socio-economic frameworks, policies. We rewrote Section 3 and added material describing the policy constraints with respect to Pakistan, India and China so it is possible now to compare the status of these countries much more rigorously. The new material (beyond editing what was there) added about  $\frac{1}{2}$  page of additional things. You can find this material on lines 194-224 of the revised manuscript.

3. My main reservation is that the exposition looks confusing at times. For instance, the examples continue in Section 3 (by the way, the case of Yemen seems to me quite divorced from the rest standing the particular situation of the area) and one cannot truly see a discontinuity between sections 2 and 3.

(response) We made revisions along the lines suggested by the reviewer to reduce

[Printer-friendly version](#)

[Discussion paper](#)



the confusion. The piece on Yemen is removed as both reviewers suggested. We have retitled Section 2 “2 Trends in Depletion and Contamination of Groundwater Continue to Worsen” and modified the introductory sentence to “In China, India, Pakistan and other hotspots (Figure 1), the impacts to groundwater due depletion and contamination are continuing to worsen for reasons that we will discuss in Section 3.” to better differentiate Sections 2 and Section 3. Please note as well the Section 2 has been extensively written, with new material added and other reworked. We think that altogether the changes have added a distinctive focus to Section 2 that differentiates it from Section 3 and reduced the confusion.

4. The lengthy text on the OCWD seems quite out of place and not in line with the rest, which focuses on Asian countries (and do we need Eq.1?). A few sentences would have delivered the same concept. Similar for the Singapore case.

(response) Our rationale with the longer section on OCWD was first to make sure that readers really understood that there are places where quantitatively verifiable groundwater management was taking place. Second we wanted to give a sense of the effort and money needed. This being said, we have trimmed this section substantially and removed the figure. Previously, it was 388 with a figure. Now it is 193 words, no figure and equation 1 removed.

5. The second part, i.e. the delineation of the proposed ideas based on the current management practice in Asia, is much shorter than the first one and not much clear in my view. It definitely needs more elaboration. The Section promises “Groundwater Research Directions” but I can’t really find clear and sufficiently elaborated indications. The first item deals with water quality; adding water quality to the management practices seems rather obvious, and it is simply done in several cases, but perhaps I have misunderstood the point (and the short text does not help).

(response) In response to comments from Reviewer #1, we have added two very substantial sections – one to the introduction (1 pg) and the second to section 3 (~1/2 pg).

[Printer-friendly version](#)

[Discussion paper](#)



The piece in the introduction explains what basic features of a groundwater management scheme should include, and particular socio-economic tools known to incentivize less pumping. In section 3, we have explained how well (or poorly in this case) aligned China, India and Pakistan are with to this framework. This we think is a reasonable response to “more elaboration” comment.

Concerning the promise of “groundwater research directions”, the best idea we had was research assuming that a lack of sustainability would create water shortages research could be useful in that area. The present draft has abandoned this idea as considered this too negative, and so research is much less a priority. So we have dropped the promise of research ideas and instead offered a few technology suggestions wireless monitoring and new GRACE and work on traditional approaches. We also recast research in water quality as a first simple step for management as suggested.

6. I agree in principle with the approach of considering the sustainable groundwater management as something that will never materialize, and the derived idea of the worst case scenario. This is something interesting and useful, and sometimes I have seen a similar approach adopted in practical management schemes. However, I see two problems with this approach. First, the analysis of the worst case scenario may anyway need significant resources for data acquisition and the understanding of the groundwater-surface water interactions, and then the several technical problems illustrated in the paper come back again.

Second, the message that may easily come out from this suggestion is the following: forget about management, too difficult and expensive, just let things go and prepare for the worst. That would mean the death of the concept of sustainable management and the triumph of “Business As Usual, with likely disastrous consequences on areas characterized by poor or absent management.

(response) Reviewer #2, similar to Dr. Fogg Reviewer #3, is concerned about the negativity in the conclusion that suggested nothing is going to happen with sustainability

[Printer-friendly version](#)

[Discussion paper](#)



and researchers need to get on with adapting to that reality. As mentioned in the comments to Reviewer #3, we have largely rewritten the conclusion. Gone is the negative view that implies business as usual by getting rid the concept of research planning for the worst. We have added more information explaining a new and potentially important role for technology and discussed traditional methods used in India and China in a more positive light. We think these changes have responded to points 1 and 2 in (6).

7. Instead, I think that a less pessimistic alternative would be to provide a management procedure made by subsequent steps of increasing complexity, starting from basic and simple analyses that may guide the management and political decision; in other words, not give up the concept of management. In this perspective, one would rather speak of “feasible management”, i.e. based on analyses that can be realistically carried out under the several constraints, starting from the simple concept of safe yield that is relatively easy to estimate in most cases. The governments and stakeholders may start making decision (import food? Invest more on different sources of water? etc.) from those basic and anyway fundamental pieces of information. Role of the scientists and engineers is to try to provide simple rules to stakeholders and managers, while complex management techniques may be affordable only by California or a few other developed regions. To this matter, the list of technical requirements brought by the paper is certainly discouraging. Thus, while the worst case scenario is something worth performing (but how about its uncertainty? Are the future stressors certain?), giving up completely the idea of management might not be so good. Again, I might have misunderstood the concept, and this part of the paper (Section 4) needs further clarification and elaboration.

(response) As mentioned in response to point 5, we think in retrospect that promising research directions was an over-reach. So this concept is gone from the previous section title and the paper has been made less pessimistic by discussing new possibilities for future monitoring and management that might come from wireless networks and GRACE. We have encouraged “feasible management” by recasting the MAR ap-

[Printer-friendly version](#)

[Discussion paper](#)



proaches they are currently using in a much more positive light.

We did not add specific suggestions about simpler management strategies for two reasons. First, The World Bank has done a great job in promoting practical, country-specific strategies – we added a sentence to the conclusion saying this. As changes prompted by Reviewer #1 has shown, the bottleneck of capacity and fractured policy is so severe that it is difficult to accomplish even simple changes. Second, this is outside the scope of the paper, and adding a small piece to the conclusion we feel would not contribute much.

---

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2019-399>, 2019.

Printer-friendly version

Discussion paper

