

Interactive comment on “

Analysis of intra-country virtual water trade strategy to alleviate water scarcity in Iran” by M. Faramarzi et al.

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...The paper is systematic and well structured. However its scientifically clear focus on specific strategies at the same time renders it less useful for policy support in water planning (which the paper claims to provide). Such support needs to look more broadly at all available water management options.

C1293

A: This study specifies how the VWT strategy may help alleviate regional water scarcity under certain national food and water objectives and constraints. We believe that the information provided here is useful for policy support in water planning. We agree that this information is not sufficient for decision making, which needs to look more broadly at all available water management options. The VWT strategy is one of the options (which is not exclusive to other options) that should be looked into, but has been generally ignored so far in the realm of water management.

Specific comments:

Explain, why water scarcity is a problem in Iran, when per capita water availability stands at 2000 m³ – is it because of mismatch of water and population distribution or is it the seasonality of water availability (which shouldn't be so critical, if groundwater serves as major storage)

A: the reviewer is right. We will give more explanation on water problems, including mismatch of water and population distribution and temporal variation of water availability. We will also make a reference to our previous work (Faramarzi et al., 2009) where these problems are addressed explicitly.

“Intra-country virtual water trade. . .would be a promising strategy” (page 2625) Why doesn't it happen at the moment? Is it because real water costs are not reflected in the product prices, or is there no market for traded products or no transport infrastructure for that?

A: It is mainly because of the former, i.e., real water costs are not reflected in the product prices. In most of the cases, water is still provided free of charge. We will specify this point when revising the paper.

The study only looks retrospectively at the degree to which food self sufficiency could have been reached or exceeded in the past. Much more important seems to be the potential to meet future food demands also under climate, population and diet changes.

C1294

A: This point is taken. We will add some outlook by using population scenarios. As for the effect of diet change and climate change, it is difficult to provide a reasonably reliable projection due to large uncertainties.

Please give at least some semi-quantitative outlook by using population and possibly also climate scenarios (that you mention on page 2621) Only individual options are tested per scenario, no combination. What happens if you combine e.g. S2 and S5? Could you always meet self sufficiency requirements?

A: The focus of this paper was on the structural change, and we could only test a limited number of scenarios. We did not intent to provide a national strategy. This would be beyond the scope of this paper.

Other water management options (e.g. wastewater reuse or “exploitation of new water resources” which is mentioned in the text, or yield/CWP increases by breeding or food storage) are not mentioned. If you wish to claim to provide IWRM policy advice or a “sustainable strategy”, you would need to test portfolios of measures.

A: we will add a short discussion on the roles of other water management options when revising the paper. However, detailed investigation of the effect of other options, other than adjusting structure of crop patterns is beyond the scope of this paper.

“Iran is unlikely to meet its national food objectives by merely implementing measures C1248 concerning improving field level management” (page 2614) – however, figure 3 shows that S5 is almost always above self sufficiency level. Explain.

A: This statement holds for cereal production as a whole. Iran is currently a net importer of maize, rice, and barley. The situation is expected to continue with population growth and increasing water scarcity. S5 only concerns wheat self-sufficiency, not total cereal self-sufficiency. Also S5 did not take into consideration that in many provinces, the ratio of water use to water availability (blue) is already very high, even over 200%. Improving irrigation water use efficiency to 70% may still not sufficient to halt the resource over

C1295

exploitation in some provinces.

“agricultural areas. . . can not be expanded” (page 2618) – is that also true if irrigation structures are expanded? Or is part of the spatial limitation a water – limitation. If so, please explore the land expansion option at least qualitatively in the text.

A: In this analysis, we assumed that total crop areas in each province will not expand because of the limited reserves as well as environmental consequences. Hence, expansion of irrigation areas under different scenarios only occurs on the existing crop areas. We will, however, provide a brief qualitative discussion on the possible effect of land expansion when revising the paper.

Similarly, please provide an estimate for the potential to increase rainfed food production by bringing yields to levels of other countries (e.g. as achieved in parts of China) and put that in relation to your blue water scenarios (how much could irrigated production decrease if green water management was improved).

A: In principle, we could run the model to test these suggested options. However, we consider that they could diverge the focus of this paper, which investigates the role of structural adjustment of crop patterns in alleviating regional water scarcity. In a previous paper (Faramarzi et al., 2010), we already investigated the impact of several stated policies to improve the agricultural water use in Iran, including: more efficient use of land and water resources at the field level, improving activities related to soil moisture conservation and retention, and optimizing fertilizer application. The conclusion there was that these measures would be unlikely to enable Iran to meet its wheat self-sufficiency objective. This conclusion motivated the current study which investigates the VWT strategy as an alternative option.

What is the difference between: interprovincial, inter-regional and intra-country virtual water trade. If they are the same you should decide for one term only.

A: There is no major difference in geographical context, but in perspectives. We will try

C1296

to use the term consistently in the text.

You announce to explicitly consider “social, economic and environmental constraints in determining optimal ASCP . . . outside of the LP procedure by assessing the LP results against. . .”, but you don't. Again, you're not addressing a “sustainable national strategy” (page 2616), but only specific individual water-exploitation and water productivity related aspects. Please rephrase.

A: The social, economic and environmental constraints (apart from water) in determining optimal ASCP are partially considered by setting limitations on the extent of structural adjustments for each crop. We are not addressing a ‘sustainable national strategy’ for water use. This is beyond the scope of the study.

While this is not the focus of the paper, you should also discuss briefly the selfsufficiency goal of Iran – at what price does that come for the country, e.g. in terms of costs for local production vs international market prices.

While this is not the focus of the paper, A: we will consider to add a brief discussion on this issue.

Explain what you mean by “trade sanctions imposed on importing countries” (page 2612)

A: ‘Trade sanctions imposed on importing countries’ refer to trade embargos and restrictions some importing countries, including Iran, are facing. We will make the point clear in the revision.

Explain what you mean by “point of no return” (page 2615)

A: ‘Point of no return’ here refers to the collapse of the agricultural system due to the depletion of water resources and environmental degradation.

“Iran will purchase. . . in 2009” (page 2615) – please update Unless you have any evidence for that “large CWP could also be achieved with small y” C1249

C1297

A: The suggestion is taken.

(page 2617), I would delete that statement. Normally CWP is closely related to yields.

A: Well $CWP = \text{yield}/ET$. This statement is supported by the situation that in some provinces the high CWP is mainly because of the small ET, instead of high yield.

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C1298