

Hydrol. Earth Syst. Sci. Discuss., referee comment RC2
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Comment on hess-2021-312

Anonymous Referee #2

Referee comment on "Social dilemmas and poor water quality in household water systems" by Gopal Penny et al., Hydrol. Earth Syst. Sci. Discuss.,
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General comments:

The article combines game theory with groundwater modelling to analyse social dilemmas and potential policy solutions related with groundwater contamination. This is a timely contribution given that groundwater contamination remains a widespread challenge. The authors' detailed description of the the game theoretical model and the groundwater modelling is informative and helpful - especially for readers not familiar with the framework proposed. I also find the application of the framework to a real-world scenario interesting. I believe further work on the case study and the discussion section would contribute to strengthen the paper. To this end, I provide some suggestions below.

The authors show the relevance of the methodology presented by applying it to the case of St. Joseph County. I would suggest the authors to further contextualize the case study. For instance, it would be of interest to include more data about the socio-economic status of residents of the two sites considered (Centre Township and Granger CDP) and housing density as well as some more information about environmental policies in place to tackle groundwater use/contamination. This would be helpful to assess the potential of the framework to understand real-world cases. Recent work on water security in the context of the US has highlighted significant inequalities that I believe it is worth discussing either in the presentation of the case study or in the discussion session, see for instance:

- Meehan, K., Jurjevich, J.R., Chun, N.M. and Sherrill, J., 2020. Geographies of insecure water access and the housing–water nexus in US cities. *Proceedings of the National Academy of Sciences*, 117(46), pp.28700-28707.
- Meehan, K., Jepson, W., Harris, L.M., Wutich, A., Beresford, M., Fencl, A., London, J., Pierce, G., Radonic, L., Wells, C. and Wilson, N.J., 2020. Exposing the myths of household water insecurity in the global north: A critical review. *Wiley Interdisciplinary Reviews: Water*, 7(6), p.e1486.

The discussion is limited to describe different social dilemmas and propose (rather vague) policy solutions. The author could work to further develop the discussion section with specific reference to the case study. For instance, I am missing a clear statement indicating to which extend the framework proposed is helpful to i) describe real-world social dilemma, ii) identify (applicable) policy solutions.

I would also suggest to further reflect on the limitations of the proposed framework especially in relation to policy solutions in a real-world scenario and to the uncertainties in the modelling. For instance, the authors assume the players are homogeneously located, do not have perfect information and they face similar costs and emit comparable pollution (l.356). How does such assumptions influence the results, especially in terms of identifying policy solutions? Loss in home value is considered as an estimate for the cost of contamination, while in the conclusion the authors suggest that more data are needed, they could also explain how does this assumption influence the findings. Moreover, I was wondering if and how the choice to focus on a case study located in the US (and not for instance a case in the Global South where groundwater contamination is also a pressing challenge) would influence the author's assessment of the potential of the framework to understand social dilemmas and advice policy making.

Minor comments:

Title: the authors might want to consider to specify that the study focuses on a case study located in the US.

l.9 – Repetition of 'three'

l.25 – Here and in other sections the authors refer to "private water systems". Perhaps the term household water systems or domestic water systems would be more appropriate in order to distinguish the water systems considered in the paper and avoid confusion with i.e. a privatized pipe-born networked systems.

l. 320-321 – It is unclear to what the letters B and E refer to.