No	Comments and Answers
1	This manuscript provides a very interesting review of the process used to develop "serious" games for social learning among stakeholders in two different socio-hydrological systems in Indonesia: a mountain slope leading to lowland paddies, and a peatland "dome". The games were developed based on hydrological studies using the Drivers, Pressure, State, Impact, and Responses (DPSIR) framework as well as analysis of the actors and stakeholders as well as the Actors, Resources, Dynamics, and Interaction (ARDI) framework. The introduction provides a good explanation of how games can influence action around water. It is particularly interesting how the study use the credibility, salience, and legitimacy framework to evaluate the two games. Answer: Thank you very much for your comments and interest in our use of the credibility, salience, and legitimacy framework
2	*The abstract concludes that "We provide clear steps in designing and adapting the game to another area…". This is the area where more is needed to deliver on this promise. As currently laid out, there is not enough information about what kind of hydrological or socio-economic study is needed to adapt such a game to new contexts. Was this based on quick assessment or multi-year study of the two areas described?* Answer: Thank you for requesting further clarity here. The socio-hydrological studies that formed the basis for the game development were a combination of previous studies and rapid assessments using established procedure to obtain information that is not yet available and needed during the game development process. We have added a list of minimum information requirements and approach for game adaptation in the section 2.1 study area: "In order to diagnose issues and develop the H_2Ours game, three knowledge system are explored and contrasted: local ecological knowledge (LEK), public ecological knowledge (PEK) and modeler/scientist ecological knowledge (MEK). Overlaps indicate starting points for the further work, gaps and contrasts issues that need attention. Minimum information requirements are based on topography and drainage systems, climate (rainfall, potential evapotranspiration), land use/cover types, their reliance on labor and inputs and expected economic returns, phenology and relative evapotranspiration. A coherent set of methods was described as a 'Negotiation-support' toolkit for learning landscapes'; it was developed in and tested for a number of Southeast Asan countries (van Noordwijk et al., 2013). The 'rapid hydrological appraisal' (Jeanes et al., 2006) is part of this toolbox. The basic understanding of the socio-hydrological context can be obtained by combining a hydrological study (climate variation in space and time, boundaries of the hydrological system, hydrological problems such as floods and droughts, and current efforts to deal with the causes and impacts of the problems), land cover study (typology, main locally relevant types, recent land cover change and life-cycle profitability estimates), socio-

	economic study (village conditions, socio-economic issues, alternative (incl. non-land-based livelihood options, institutional history)." *What number of game simulations and what number of actual players are needed?* Answer: As for any tool, the way it is used depends on specific targets that the user may have. Games can be used for raising awareness (agenda setting), for increased and shared understanding of how things work (hydrologically, socially, and in interactions), for framing issues and setting goals to deal with them and or for exploring means of implementation for achieving these goals. The number of game replications, choice of players in homogenous or explicitly mixed groups and the balance between 'experience' (letting many stakeholders play and draw their own conclusions) and 'evidence' (documenting and further analyzing game outcomes by researchers) can be decided by a game user. For the specific examples of the adaptation of H2OURS to two landscapes in Indonesia, we added explanation in section 3.3 Game implementation: "The simulation of H_2Ours game takes approximately two hours (excluding briefing and debriefing). For the Rejoso watershed version, the H_2Ours game consisted of 10 rounds with 6-12 players divided into 3 groups acting as local communities: upstream, midstream and downstream. The PHU Pawan-Kepulu version consisted of 8 rounds with 8-16 players divided into 4 groups, and players are asked to select their village name as first step of creating ownership. In both versions, an additional group of players consisting of 2-4 people can act as public stakeholders (government, companies, NGOs) and interact with the villages." A future paper will further analyze the specific results obtained in the two landscapes. *The other gap in the paper is a description of who played the game, and whether there were differences in how different types of players responded in the game, or in their interactions with each other. For example, were all the players men?* Answer: We will elaborate Section 2.4 Game implementation line 198: "In this study, we executed ten game sessions with different participant groups with a total of 93 participants. The ten game sessions consisted of five sessions at each study areas. The five game sessions consisted of a session with a multi-stakeholder forum consisting of representative of governments, NGOs, private sectors, and universities to get ideas on regulations and programs that would be offered to local communities/farmers, and four session with farmer groups to implement the regulations and programs resulting from the game simulation with the multi-stakeholder forum. In each session with farmer groups in Rejoso watershed, we invited a total 9-12 representatives of farmer groups from upstream, midstream and downstream village to a meeting hall where all participants could still reach it. While in each simulation in Pawan-Kepulu peatland, we invited 12-16 representatives of farmer group from four villages in that landscape. In the invitation, we let the group determine who would attend the simulation, provided that the

	group representatives were willing to hold discussions and exchange information with participants from other villages. During the game simulation, we asked the invited farmers to behave as farmers in line with the position of their village in the landscape." "For the four sessions with farmer groups we selected participants according to different criteria. For Rejoso watershed, we conducted two sessions with participants who had experience with a recent Payment for Ecosystem Services (PES) program (Leimona et al., 2018) and two sessions with participants from neighboring villages where the PES program was not active. Meanwhile, at PHU Pawan-Kepulu we conducted a game session with members of the village forest management unit, a session with members of an active farmer field school, and two sessions with people who are not members of village forest management unit and farmer field school. Follow-up manuscripts are planned that will provide further analysis of these contrasts in player background. (Tanika et al, in prep)" *Did the players from upstream play differently than those from downstream areas, even if they were not playing the parts of their own area?* Answer We will integrate in the discussion section 4.2 Game evaluation and lessons learned: "In this research, we invited people from upstream, midstream and downstream to play according to their location. We did not yet have the opportunity to conduct simulations with role-switching players, but this can be done and can provide further insights. Recommendations for further research that makes use of the H_2Ours game are to allow players to switch roles to see how responses and perceptions depend on such shifts."
3	*Line 173 says "profit is total income minus total capital". But if income is on an annual or seasonal basis, shouldn't that be the annualized cost of the capital (e.g. if there is a major outlay for pumps)? Or should that be "minus total costs" (which is what it says in the next sentence). In economic terms, there is a difference.* Answer: We will revise Line 173: "profit is revenue minus all financial expenses (taxes, cost, incidental cost, etc.). The underlying economic analysis applied a life-cycle perspective to the various land use systems, annualizing discounted future cost and benefit flows".
4	*Figure 4B X axis is labelled Amount of groundwater), but shouldn't that be amount of surface water, or runoff?* Answer: Yes, it should be 'amount of Surface water (ml)'. Thank you for your correction. I revised Figure 4B
5	*Figure 4C and D, what does it say that the actual choices by the participants were so much below the simulated income, and mostly lower groundwater and runoff?*

	Answer: We will provide a clearer explanation about the comparison between solution space and simulation results in the results section 2.3.4 Game solution space analysis and in the discussion. "The presence of relationship values between humans and nature and humans and other humans (relational values) influences decision making regarding natural resource management (van Noordwijk et al., 2020). Therefore, the decisions made by players during the game are influenced by various factors (e.g. interactions between players, game settings, level of player ecological knowledge, etc.) (Rodela R and Speelman, E.N., 2023, manuscript in review), whereas random decision making is used to build solution space. For example, when the upstream and midstream groups decided to maintain and improve their economic conditions, they caused a reduction in groundwater supply and increase flooding for downstream area, which caused the downstream group to pay for the losses it experiences. Apart from that, during the simulation the facilitator also provided Payment for Ecosystem Services (PES) scenarios (Appendix A, Game Play number 9: repeat step 6 for the rest of the rounds with additional scenarios such as providing payment for ecosystem services). This scenario offers downstream groups to contribute a certain amount of money to maintain more trees in the upstream and midstream. Therefore, the downstream groups economically always spend more money either as a loss due to the environmental consequences (floods or water scarcity) or as a prevention effort by joining the PES program.
6	*Figure C1: how do the villages match the peat dome?* Answer: Referring to Figure 2A (PHU Pawan-Kepulu), in reality the positions of peat domes are spread across several villages with different distribution. There are villages dominated by peat domes and buffering areas, and some of them are dominated by shallow peat. But, in the game board design, the distribution of peat depth (including peat domes) is distributed evenly in all villages. This is intended to facilitate replication for other locations. We will add further explanation regarding peat dome distribution across the village in Appendix C "The hydrological boundary of peatland in peatland hydrological unit (PHU) as an area between two rivers. Usually inside this landscape we can find a dome (the deepest peat area), area surrounding dome (buffering dome area) and shallow peat area. The peat depth are spread across villages with different distribution. However, to facilitate the replication of the game, we designed the distribution of peat depth (including peat domes) is distributed evenly in all villages. Figure C1 shows the conceptual game model of H2Ours game for peatland version. However, for further simulation, we can design a game board with different peat depth distributions for each village"
7	*The paper needs a good copy editor throughout ,including the appendix.* Answer:

	Thank you for pointing this out. We will scrutinize the next version to be submitted.