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Comment on egusphere-2022-617

Laura Uusitalo (Referee)

Referee comment on "Developing a Bayesian network model for understanding river catchment resilience under future change scenarios" by Kerr J. Adams et al., EGUsphere, https://doi.org/10.5194/egusphere-2022-617-RC1, 2022

This paper reports an ambitious work of a Bayesian network model created together with stakeholders to evaluate future scenarios on a watershed. I appreciate the effort put to the stakehodler interaction, which is also reported very well.

I have some things / questions that I would like to see addressed in the paper.

1) I think a picture of the model should be presented. I understand it can be complex, but I also understand it was presented for the stakeholders in the workshops, so it should be possible to present it also in the paper, or at the minimum in the supplement. It would make it easier for the reader to undertand the model.

2) It seems from the supplement that the model was parameterized using deterministic equations. Usually Bayesian Networks are use specifically to model also the uncertainty that is related to the model parameters. Please discuss this and explain your modelling choice.

3) The use of simulations to evaluate the results is a bit unclear. We don't usually use simulations as such to evaluate the outputs of a BN, but we aim to compute the total probability disctibution over the modelled domain, given the conditional probability distributions and the model structure. This way, we can then reason "backwards" (what is the most brobable cause given the consequences), compute the probabilities ofoutcomes given a number of causes or observations, etc. In the case of disctrete models, this can be done analytically, and in the case of continuous models, the distributions are often approximated using simulations, but BNs are not usually simulated as such. When continuous BNs are run/solved, often using Monte Carlo Markov chain computation, the early part of the Markov chain is usually thrown out to make sure that the chain has converged to the true distribution (burn-in). This wasn't mentioned in this paper, and I was left uncertain about the modelling technique. Please explain it more clearly. Also, BNs

are supposed to give the best available assessment of the *probabilities* of the events (given the scenarios etc.), so it should not be necessary to refer to "x out of y simulations" whan discussing the results.

4) Maybe go further back to the roots (such as Perl 1986) when explaining what BNs are in the introduction.