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Interactive comment on “Climate impacts on human livelihoods: where uncertainty matters in projections of water availability” by T. K. Lissner et al.

Anonymous Referee #2

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General Comments

This paper attempts to systematically assess climate impacts on livelihood via a methodology called AHEAD, which combines the effect of a variety of climate impacts, and the appropriate assessment of model uncertainties. The paper focuses on water availability (as an example) using results from ISI-MIP, and ascertaining when model uncertainty is significant to livelihood predictions and when it is not. The overall goal of the methodology is to digest model results for policymakers, including ascertaining relevance of various uncertainties.

The authors' approach in doing this is to begin with a long list of subjective elements

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(listed in Section 2.1), and attempt to quantify them through impact model output and what turns out to be a simple scheme based on fuzzification. However, this translation (from qualitative to quantitative) is necessarily arbitrary. This puts the whole endeavor on thin ice. Such a translation would seem to demand transparent methodology, thorough examination of assumptions, careful justification of every step, and precise language.

I feel that the overall goal of this paper, to meaningfully digest impact model results and uncertainties, is important. However, I feel that the methodology presented here is perhaps too qualitative, and the presentation too imprecise, to successfully advance this goal. Furthermore, there seem to be some culturally-specific assumptions underlying this work (e.g. the necessary factors for adequate livelihood), which should perhaps be given explicit consideration.

Specific Comments

404.12 I find the acronym "AHEAD" to be awkward.

404.13 "Based on a transdisciplinary sample of influential concepts" sounds vague.

404.13 The word "influential" here weakens the presentation. Similar persuasive rhetoric appears often in the paper, and is not helpful.

408.6. I do not understand the clause, "To measure the fulfilment AHEAD." Dividing the 16 elements into 3 categories may be a prerequisite to measurement, but is not the act of measurement.

409.7. 'However, the idea of adequacy is easily presented in linguistic categories, for example "sufficient water is available".' I find this sentence to be too simple, and also tautological (i.e. "sufficient" is a synonym for "adequate" here). Does "sufficient" mean "sufficient to drink"? Or "sufficient for subsistence agriculture"? Or "sufficient for non-native landscaping"? This sentence highlights the fundamental tension between the qualitative and the quantitative in this paper. A more sophisticated and precise

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treatment of this tension might be needed.

Equations 1-4. I would be interested to see how results would change if every variable swapped shape of membership function. I'm not convinced that the level of precision implied by the use of two classes of shape is relevant to the results.

Equations 1-4. How much uncertainty is introduced by use of these idealized functions?

411.25. $\Gamma = 0.6$ seems arbitrary.

412.10. These definitions of ι_1 and ι_2 should be moved to where the variables are first introduced.

412.16. "Applied fuzzification methods for each variable are motivated by scientific findings." This is vague. What "scientific findings"?

413.13. What are "micro credits"?

413.23. I am not inclined to agree with the implication (by inclusion in the same dimension group) that cell phones and the internet are equivalent in importance to the other infrastructure factors such as shelter or health care. I think there is an underlying assumption in this work as to what is necessary for adequate livelihood, which is critically culture-dependent.

414.1. "Thresholds ι_1 , ι_2 , as well as the shape of the membership function (Eqs. 1–4) to fuzzify each input dataset are motivated by relevant findings." Again, this is too vague. If I wanted to apply this methodology, this sentence would not help me.

419. I feel that the discussion of the relevance of uncertainty (an important point) is needlessly complicated. The basic idea is simple: if uncertainty in the best-estimate value causes it to cross a threshold, the uncertainty is relevant.

421.8. "The approach builds upon influential concepts..." The claim here that the concepts are influential does not add to the argument, but rather detracts.

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421.10. "The selection of indicators and data for the purpose of quantification focusses on a holistic representation of important aspects." Again, statements like this do nothing to advance the discussion.

424.6. "Uncertainty has often been blamed for inaction in terms of climate mitigation and adaptation." Please add a reference.

General: Why is it necessary to use a political grid in this study?

Table 1. Some explanation for "country-specific MDER" is needed.

Table 1. What does $200/(1000 \text{ cap}^{-1})$ mean? Do you mean 0.2 cap^{-1} ? (This applies to similar units within the table.)

Table 1. For the "communication" category, why are the lower and upper bounds 0% to 100% respectively?

Table 1. I find the implicit claim that 0.5 cap^{-1} motor vehicle density is necessary for "adequate livelihood" to be a conundrum in a paper about climate change, and another culturally-specific assumption.

Fig. 4. This figure is difficult to parse. I assume the middle column is meant to use the right y-axis? Why do some countries and columns have a wide vertical range of values (I assume due to different RCPs) while others have a small range? Why do the cells with a small range also have identical values for each impact model? What is the takeaway message from this figure?

Fig. 5. I don't understand what the hatching signifies, "changes towards the 2090".

Tables A1 and A2. It's not clear to me what these tables contribute to the paper. Consider explaining their significance in the captions.

Technical Corrections

Table 1. Font is too small. Please use multi-page table.

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Figure A1 too small to read.

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