

**Revision Notes of the Revised Manuscript**

Manuscript NO.: Egusphere-2026-160

Title: Integrating multidimensional factors through Bayesian Belief Networks for landslide and debris-flow risk reduction in subtropical zones

Submitted to: Natural Hazards and Earth System Sciences (NHESS)

**Letter to editors and reviewers:**

Dear editors and reviewers,

Thank you very much for your useful comments, we are now pleased to resubmit the revised version of Egusphere-2026-160 title: *“Integrating multidimensional factors through Bayesian Belief Networks for landslide and debris-flow risk reduction in subtropical zones”*. Based on the comment of first reviewer, the authors changed the title to: *“Integrating multidimensional factors through Bayesian Belief Networks for landslide risk reduction in subtropical zones”*.

We would like to thank the reviewers for careful and thorough reading of this manuscript and for your suggestions, which helped us to improve the manuscript. We have carefully considered all the suggested changes and revised the manuscript accordingly.

Please refer to "Detailed response to reviewers' comments" below for studying the changes.

Yours Sincerely,

On behalf of all authors who read and agreed on the revised manuscript.

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## Detailed response to reviewers' comments:

----- Reviewer #2 -----

### Major Comments

1. In the introduction section, the author should present a more structured explanation and provide why the BBN network is used, and what its advantages are.

**Answer:** Thank you so much for your suggestion.

*“...Prediction models like conventional Random Forest and Neural Networks show good performance, but they are black box models that do not provide much understanding of cause and effect between factors. Bayesian Belief Networks (BBNs) on the other hand offer a probabilistic approach that is capable of incorporating environmental, geological, climatic and socio-economic variables and explicitly modeling the interactions between them. Moreover, BBNs can be applied to handle uncertainty, analyze scenarios and offer interpretable results in disaster risk management and decision making. Thus, the BBN approach is deemed appropriate for this study because in general, multiple interacting factors and uncertain environmental conditions have to be taken into account to assess the landslide hazard and risk...”*

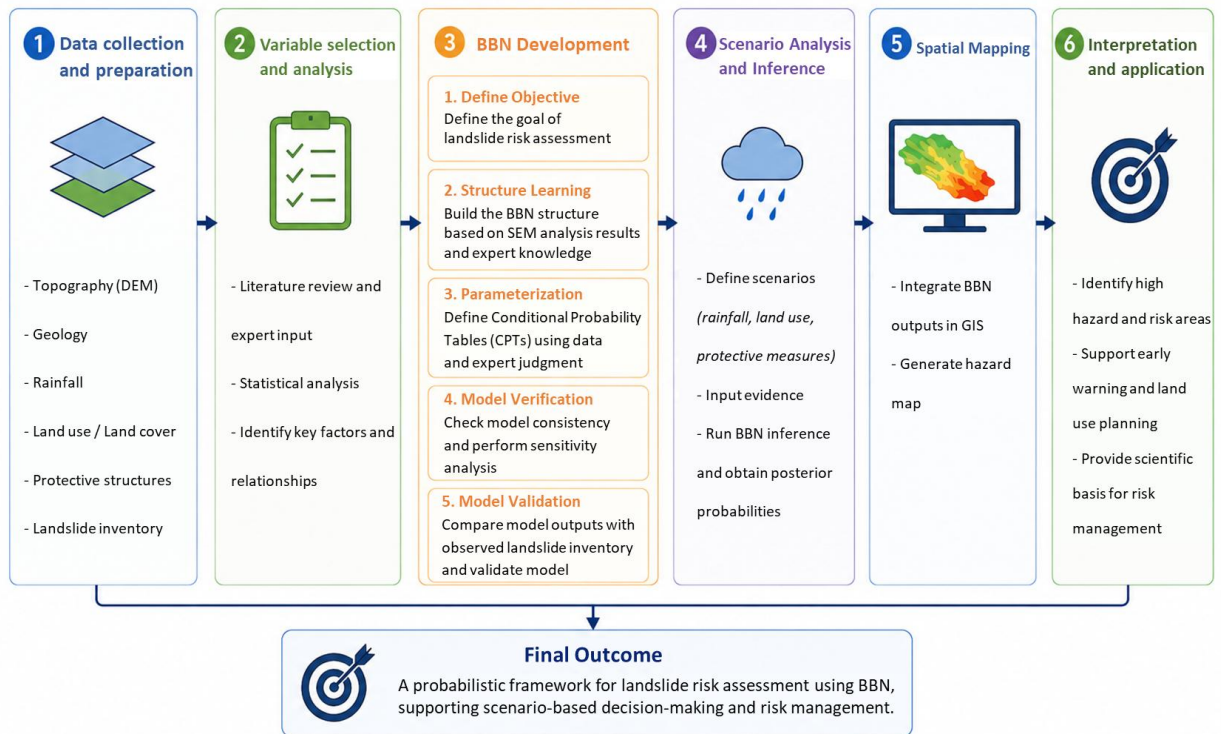
The above content was added to the introduction section of the revised manuscript.

2. The current manuscript needs to be polished by a native English speaker or professional language editing service. The existing version has very long paragraphs, making it difficult for readers to follow the important information the author wants to convey. For example, section 2.2 BBN development for warning landslides and debris flows. There are too many technical descriptions, and although some processes are visualized (Fig 4 shows step2), a diagram showing the overall framework would help readers understand it better.

**Answer:** Thank you so much for your suggestion.

We thank the reviewer for this constructive comment. We agree that the manuscript would benefit from improved language clarity and a more structured presentation of the methodology.

In the revised manuscript, the text has been carefully edited to improve readability, reduce excessively long paragraphs, and better highlight the key information. In particular, Section 2.2 has been reorganized into shorter and clearer subsections to make the BBN development process easier to follow.



**Figure 2.** Workflow to develop a BBN for landslide risk assessment.

In addition, we have added an overall methodological framework diagram to complement Figure 2 and provide a clearer visualization of the workflow, including data preparation, variable analysis, SEM validation, BBN construction, scenario analysis, and hazard mapping. These revisions improve both the readability and interpretability of the study.

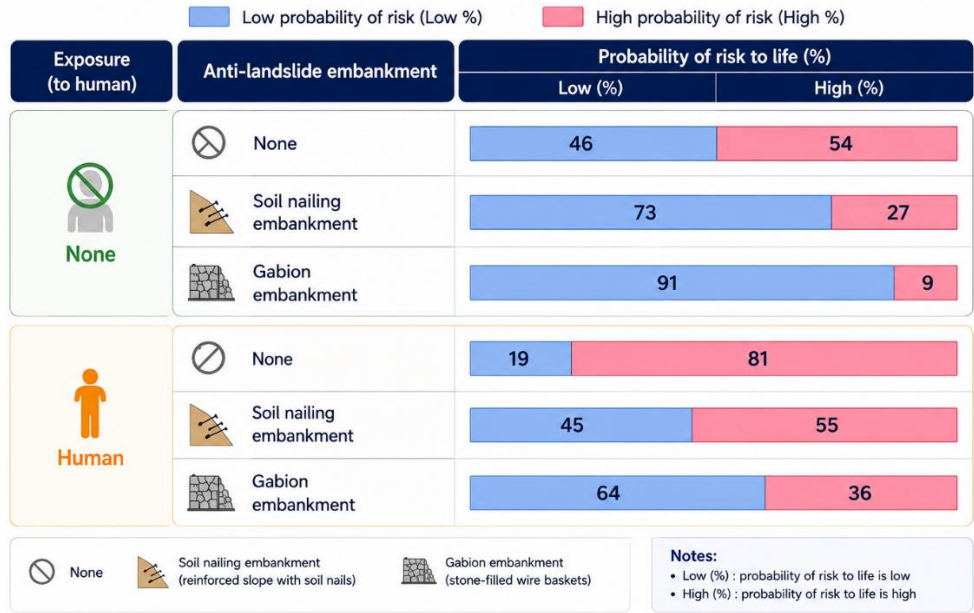
3. When introducing their case study in section 2.1, the author should provide a general or detailed list of landslides and debris flows in Vietnam. It is recommended to delete paragraph 145 of the discussion, as it is irrelevant to the data. The relevant discussion should be included in the introduction.

**Answer:** In the revised manuscript, we have added a concise overview in the “Case study” section describing the occurrence and distribution of landslides in Vietnam, particularly in mountainous regions of the Northwest, where intense rainfall, steep terrain, and infrastructure development frequently trigger landslide events. This addition helps establish the national context and better justifies the selection of the Da River basin as the study area.

In addition, the paragraph previously located in paragraph 145 has been removed and its relevant content has been integrated into the Introduction to improve the overall logical flow and consistency of the manuscript.

4. When discussing results, adding visualizations to the results instead of table can enhance the reader's understanding.

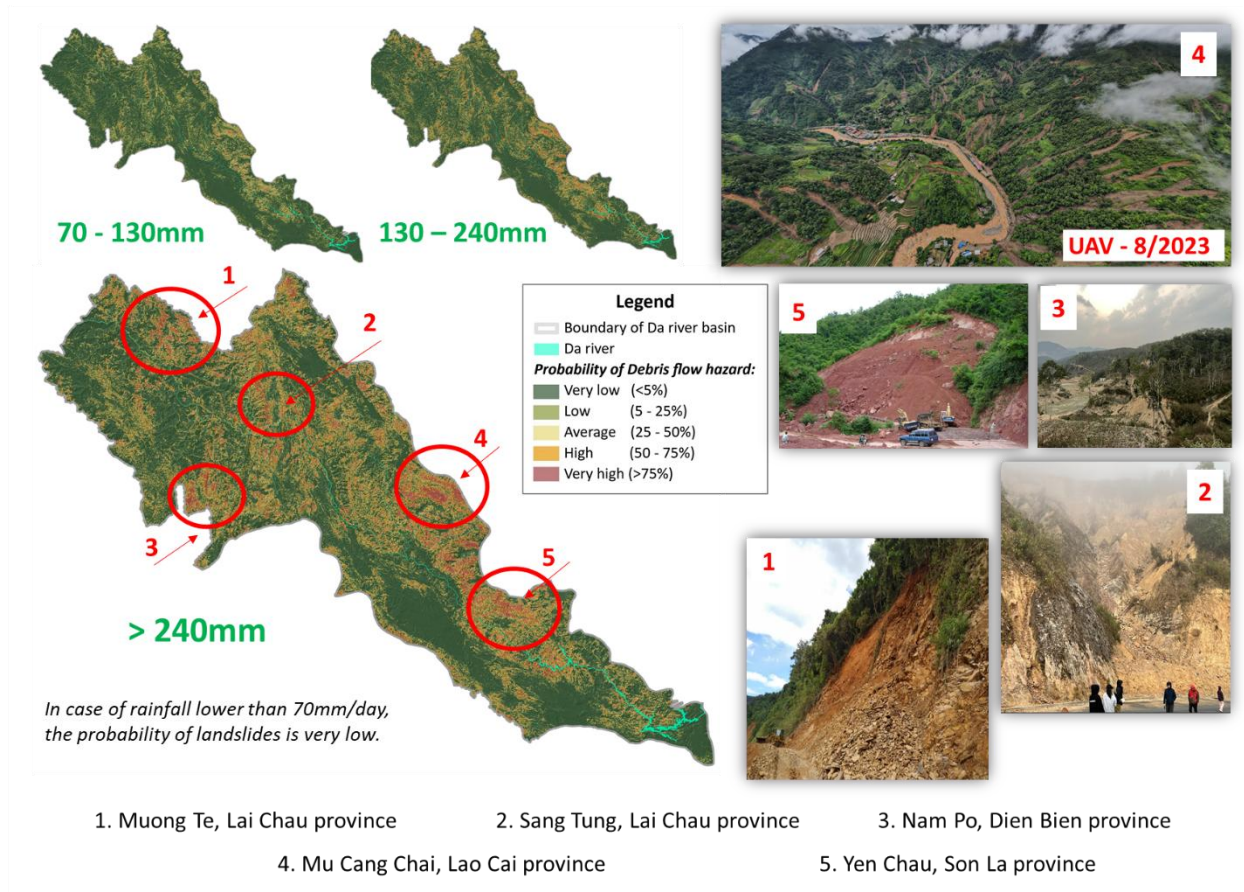
**Answer:** In the revised manuscript, several key results previously presented only in tables have been supplemented with graphical and spatial visualizations, including workflow diagrams (Figure 2), probability distribution figure (Figure 8 and 9), and scenario-based hazard maps (Figure 10), as follows:



**Figure 8.** Probability of risk to life under the protection of different anti-landslide embankment.



**Figure 9.** Probability of risk to building and road under the protection of different anti-landslide embankment.



**Figure 10.** Probability map of landslide occurring in three rainfall scenarios based on BBN model in the Da river basin.

These visual outputs provide a clearer representation of the spatial patterns, factor interactions, and scenario responses within the BBN model, making the results easier to interpret and compare. These revisions significantly improve the clarity and presentation quality of the manuscript.

**Thank you so much!**