General Commets:

The manuscript addresses a relevant and timely topic: the assessment of wildfire hazard in the Andean and Amazonian regions of Peru, where fire activity has important ecological, social, and operational implications. The proposed Wildfire Hazard Index (WHI) has potential value for regional wildfire monitoring and early warning applications.

The study is clearly motivated and uses datasets that are broadly appropriate for this type of regional hazard assessment. The attempt to develop an interpretable index, rather than relying only on complex data-driven methods, is also a positive aspect, particularly for operational use in data-limited regions.

However, the manuscript would benefit from substantial revision before publication. In particular, the methodological choices behind the construction of the WHI, its weighting scheme, hazard classification, and validation need to be explained more clearly and justified more rigorously (I don't think “calibration” is the best word to describe what you did). I also recommend reorganizing the Results section so that the model outputs are first presented as results of the proposed WHI, followed by a separate section dedicated to model validation or evaluation. This would make the distinction between model results and model performance clearer.

Overall, the manuscript has potential and addresses an important regional gap, but its scientific robustness and presentation need to be strengthened. I therefore recommend major revisions. I’ll go over the specific comments (in the attachment). I know they might seem like a lot (or a bit long), but it’s just to explain why I think the way I do, and also to have a little “discussion” of ideas among us.

Specific Comments:

Abstract:

Line 22: The abstract should avoid overly general or circular statements such as “lower WHI values correspond to lower wildfire hazard.” This is expected by definition and does not add much scientific information. The space could instead be used to summarize the main regional or seasonal findings of the study.

Introduction:

Line 30: The Introduction provides a broad and relevant overview of wildfire activity and wildfire hazard assessment. However, the opening paragraphs are somewhat general and could be more focused on the specific motivation of the study. I recommend streamlining this section to guide the reader more directly from the

broader wildfire problem to the specific need for a wildfire hazard index for the Andean and Amazonian regions of Peru.

Line 39: The manuscript introduces the concept of wildfire hazard and refers to wildfire indices and wildfire occurrence. However, the distinction between wildfire hazard, fire occurrence, fire activity, and wildfire risk should be clarified early in the manuscript. Since the proposed WHI does not explicitly include exposure or vulnerability, it should be consistently framed as a hazard or fire-prone conditions index rather than as a risk model.

Line 44: The authors discuss several factors influencing wildfire hazard, including fuel moisture, meteorological conditions, topography, drought, vegetation conditions, and agricultural fire use. This discussion is relevant, but it should be more explicitly connected to the variables later used in the WHI. This would help justify the selection of the input variables.

Line 70: The manuscript states that wildfire hazard indices have been applied in several South American countries, but that their applicability to the Andean-Amazonian regions of Peru has not yet been rigorously evaluated. This is an important motivation, but the scientific gap should be stated more explicitly. The authors should clarify whether the main gap is the lack of a Peru-specific index, the limited validation of existing indices in Peru, the absence of short-term operational hazard products, or the need to incorporate anthropogenic fire-use information.

Line 75: The objective of the study should be stated more precisely. The final sentence refers to climatic and vegetation-related factors, but the proposed WHI also includes anthropogenic and fuel-related components. The objective should therefore reflect all major components of the index and clearly state what distinguishes the proposed approach from existing wildfire hazard or fire weather indices.

Study area:

The Study area section would benefit from a summary table describing the main biophysical characteristics of each of the nine regions used in the analysis. Such a table could include, for example, elevation range, dominant land-cover or vegetation types, precipitation regime, main fire-prone ecosystems, and the relative

importance of agricultural activity. This would help readers understand why the regionalization is relevant for wildfire hazard modelling and interpretation.

Line 91: The description of precipitation and elevation gradients could be expanded to include a more harmonized discussion of the western and eastern Andean slopes. Since the Pacific slope, eastern Andean slope, and Amazon basin have distinct climatic, vegetation, and fire-regime characteristics, the manuscript should more explicitly explain how these physiographic contrasts influence wildfire hazard and the interpretation of the WHI across regions.

Line 109: The final paragraph of the Study area section introduces the availability of climate and satellite datasets. While this information is relevant, it overlaps with the following Data and Methodology section. The authors could either shorten this paragraph or use it more explicitly to explain why the selected datasets are suitable for this study area. If not, it should be included in the next section.

Figure 1: The cartographic presentation of the study-area map should be improved. In particular, the elevation map would be easier to interpret if a more intuitive colour scale were used, ranging from green for lower elevations to brown for higher elevations. The elevation legend should also be displayed vertically, which would make the altitudinal gradient clearer. In addition, the ocean should be represented with a distinct colour from the neighbouring countries, to avoid confusion between marine areas and land outside the study area.

Metodology:

Line 120: The historical data should be described in more detail. The authors should clarify the time period covered, the definition of a “wildfire event” or “wildfire emergency”, the spatial precision of the records, and whether these data represent ignition points, affected locations, administrative reports, or emergency declarations. This is particularly important because these data are later used for model evaluation.

Line 145: The choice of input variables is reasonable, but the manuscript should better justify why these four components were selected and why other potentially relevant factors were excluded, such as, temperature, relative humidity, slope, aspect, etc. This is particularly important because the Introduction mentions topography and meteorological conditions, but these are not fully represented in the WHI.

Line 153: The normalization of Dry-Day Frequency using the 75th and 99th percentiles should be justified more rigorously for the study region.

Line 169: The NDVI normalization procedure should be clarified. The use of the April historical maximum as the reference for peak vegetation vigour may not be equally appropriate across all regions of Peru, given the strong climatic and phenological differences between the coast, Andes, and Amazon. The authors should justify this choice and explain whether regional or pixel-specific seasonality was considered.

Line 179: The anthropogenic fire-use component assumes a link between planting intentions and agricultural burning. This is plausible, but the authors should provide stronger justification and discuss its limitations. Planting intention does not necessarily mean fire use, and the timing of burning may vary by crop, region, altitude, and local practice.

Line 199: The AHP weighting procedure is not sufficiently transparent. The authors should provide the pairwise comparison matrices, the final weights for each region or scenario, and the consistency ratio (in the Results).

Line 213: The WHI classification into six hazard levels appears to use equal intervals from 0 to 3. The authors should explain why these thresholds were used.

Figure 2: The flowchart is useful for summarizing the proposed WHI framework, but the final steps should be clarified. The last two blocks, currently referring to "Uncertainty analysis - WHI classification" and "Proposal for a wildfire hazard index (WHI)", appear to mix model construction with model evaluation. Since the comparison with wildfire emergencies and MODIS hotspots is used to assess model performance, these steps should be explicitly labelled as model validation or model evaluation, or with another consistent terminology adopted by the authors. This would make the workflow clearer by distinguishing the construction of the WHI from its subsequent evaluation.

Results:

- The Results section needs to be reorganized. The main objective of the manuscript is to develop and propose a new Wildfire Hazard Index (WHI); however, the Results section starts directly with model performance and comparisons with reported wildfire events and the CFOI product, before clearly presenting the WHI model outputs themselves. I recommend that the authors first present the final AHP-derived weights and/or optimized parameters, followed by the spatial, seasonal, and regional patterns

produced by the WHI. Only after this should the manuscript include a separate subsection dedicated to model evaluation or validation against observed fire activity, including reported wildfire emergencies, MODIS-derived hotspots, and the CFOI product. This structure would make the contribution of the proposed model clearer and would avoid giving the impression that the results are mainly focused on the validation datasets rather than on the WHI itself.

- Some methodological aspects currently appear for the first time in the Results section and should be moved to, or explained more fully in, the Methodology. For example, the calculation of Success Rate Curves, AUC values, correlation coefficients, significance levels, and the procedure used to select the optimized parameters should be described before the results are presented. The Results section should report the outcomes of these analyses rather than introduce the methods used to calculate them.

- Some parts of the Results section are written more like interpretation or discussion than as a presentation of results. For example, statements claiming that the model "can effectively represent and distinguish seasonal wildfire pattern – line 294 to 296" or "These findings suggest that the model effectively captures – line 281 to 282" should be moved to the Discussion, or at least clearly separated into a model evaluation subsection (other example, Line 276 to the discussion (limitations)). The Results section should, for example, first present the observed patterns and statistical outputs, while the Discussion should interpret why the model performs differently between the Andean and Amazonian regions.

Discussion:

The Discussion should be more clearly separated from the Results. Several statements in this section repeat results that were already presented earlier, particularly regarding regional model performance, the difference between Andean and Amazonian regions, and the use of hazard level 5 versus levels 4 and 5 combined. The Discussion should focus less on restating the results and more on explaining why these patterns occur and what they imply for wildfire hazard modelling in Peru.

Line 374 and 378 (for example): Part of the Discussion reads more like background or state-of-the-art material than interpretation of the study results. For example, the paragraph discussing the use of satellite data to capture vegetation moisture,

vegetation response to precipitation, and the integration of GPM and MODIS products would be more appropriate in the Introduction, where it can help justify the methodological approach. In the Discussion, the authors should instead focus on what the use of these satellite-derived products revealed in this study, how it affected WHI performance across regions, and what limitations remain when applying MODIS and GPM data in complex Andean and Amazonian environments. And you can use this example, for other parts of the discussion.

Some limitations are mentioned but not fully connected to their implications for operational use. **For example**, the use of district-level planting intentions as a proxy for agricultural fire use, the absence of multiple variables,etc. The authors should explain how these limitations may influence the interpretation and operational application of the WHI.

Line 469: The final part of the Discussion introduces machine learning approaches, but this discussion feels somewhat disconnected from the main contribution of the manuscript. If retained, it should be better linked to the limitations of the current WHI and to specific future improvements.

Conclusion:

Line 477: The Conclusions section should be more concise and more directly focused on the main findings of the study. The first part repeats general background information about wildfire frequency, drought, and agricultural burning, which has already been discussed in the Introduction and Discussion. The authors should instead begin by summarizing the main contribution and findings of the proposed WHI.

Line 484: The statement that the results demonstrate consistency between WHI outputs and fire activity should be made more specific. The authors should summarize the main evidence supporting this conclusion.

Line 485: The conclusion that the model “adequately captures the seasonal variability of wildfire hazard” should be phrased more cautiously. The Results show that performance varies between regions and hazard levels, so the conclusion should explicitly acknowledge that the model performs better in some regions than others. And this should also be taken into account in the results and discussion.

Principal criteria	Excellent (1)	Good (2)	Fair (3)	Poor (4)
Scientific Significance: Does the manuscript represent a substantial contribution to the understanding of natural hazards and their consequences (new concepts, ideas, methods, or data)?		x		
Scientific Quality: Are the scientific and/or technical approaches and the applied methods valid? Are the results discussed in an appropriate and balanced way (clarity of concepts and discussion, consideration of related work, including appropriate references)?			x	
Presentation Quality: Are the scientific data, results and conclusions presented in a clear, concise, and well-structured way (number and quality of figures/tables, appropriate use of technical and English language, simplicity of the language)?			x	