

In this paper, authors introduce the implementation of an innovative software tool to assess fire risk using both the well-known static drivers and dynamic drivers, including weather conditions before the fire event. In addition, fire hazard is evaluated considering the vulnerability of exposed elements under present and future conditions. The model has been developed under the k.LAN platform using FAIR data and resources, which makes it open and freely accessible for other researchers and stakeholders. Authors use Sicily as a case study to illustrate this software implementation. Results allow to: (i) assess the relative importance of the driving variables to fire hazard; and (ii) elaborate risk maps and exposure maps for two periods, 2020 and 2050, under climate change scenarios. Different indicators for model evaluation, based on confusion matrix, are provided in the paper.

This manuscript addresses relevant scientific and technical questions within the scope of NHESS and up to international standard. The accurate description of the data, methods, experiments and computations, as well as the results obtained, allow the reproducibility of the study. Data and code have been made available on an open repository, Zenodo. English language is good and the number and quality of the references appropriate.

This paper provides a good contribution to the research in fire risk. In my opinion, it can be accepted after a few revisions and technical corrections listed below.

The TITLE is too generic. I propose to choose a title more focused on the present study, such as “Fire risk in Sicily: an integrated data-driven approach” or similar.

TERMINOLOGY. In general, to indicate the phenomenon you often use “fire”, and sometimes “wildfires” or “forest fires”. Since this study focuses on unwanted fires affecting the WUI and the WAI, you should specify and use always “forest fires” (the most used in Europe).

Section 2.2 “Fire risk analyses”: despite the accurate description of the three elements (hazard, vulnerability, and exposure) provided to define the risk, the type of risk you estimate in the present study is still not clear at this point. From what can be inferred in the following, you are estimating a probabilistic risk, express a probabilistic value (or likelihood) for an area to experience a fire event given certain conditions (that you can quantify) of hazard, vulnerability, and exposure. Please add a few lines of description to clarify this point within section 2.2.

The quality of the FIGURES is generally very low and needs to be improved. There are several errors in different figures as specified below.

- Figure 1 seems to be not correct: the histogram is not a cumulative frequency, but simply the total number of fires over the entire study period by region. The legend has to be translated in English and the font size increased to be legible. The same colormap used for the histogram should be applied to the map.
- Figure 3: I propose to move this as supplementary material and, instead, elaborate a new image to illustrate the global workflow of the methodology, from data acquisition to fire risk and exposure mapping, including model evaluation. This can also be used as graphical abstract.
- Figure 6: it's not clear since it's all black line. Please remove the administrative black borders of the municipalities.
- Figure 10: This graphic is useful only if you compare two or more models. In this case, you can simply indicate the AUC value within the text and remove the figure.
- Figure 11: move up, below Fig.5

- Figure 12: “Example of average fire occurrence in August 2020 (a) and 2050 (b).” → why you define it “average fire occurrence”? It’s not a probability value? Please correct.
- Figure 14: “...in August 2018 and 2050” → I suppose that it’s 2020, not 2018.
- Figure 16: “Colored from red with a value of 0 (low socio-environmental value) to blue with a value of 3 (high socioenvironmental)” → colors red and blue seems to be in the reverse order.

Somme error in Table 2:

- For the “Spatial resolution” of “Historical fire perimeter” please indicate the accuracy / minimum detectable area.
- “Temporal resolution”: it’s not resolution but “Time consistency”. Which is the true temporal resolution? daily, monthly, yearly? Please indicate both in the table (consistency and resolution/accuracy)
- “CRS”: Indicate in full “Coordinate reference system”

Table 3 is not more informative than the description provided in the text. Please remove it or move and merge with Table 4.

In Table 4:

- “Unite” for the Temperatures: please indicate “Celsius degrees”
- “Count of Day without Precipitation” I suppose in # and not mm
- “Unite” for “Biomass of Forest during Fire” → you can indicate “see in (S1) Fig. S1”

Some punctual error to be fixed:

Line 28: 25,711 km²

Line 82: add reference and website for ARIES (<https://aries.integratedmodelling.org/>)

Line 95 : no need to make a list/numbering, just simple text

Line 110 : a full stop is missing between « southwest Thus, »

Line 146 : « fire start and **end** date »

Line 163 : explain better the needs of "pseudo-absences" to avoid overfitting.

Line 194 : is the range for fuel type based on the flammability? please specify since it's important for the model implementation to know if it is a categorical (just a label) or a true numerical variable.

Line 204 : the description of the BN model can be moved on a separate sub-section.

Line 235 : full stop is missing at the end of this sentence.

Line 241, with reference to S2 Table S1 : How can the max limit in the range be lower than the value for the highest bin? for example for "acc week prec" the range is 0.00-18.75 and B10 = 81.78 (but it's not the only case)

Line 160 : I suggest to rename the subsection « 2.2.2. Drivers of vulnerability **and exposed éléments** »

Line 269 : few lines to introduce ARIES are needed, as I suggested above.

Line 277 : full stop is missing at the end of this sentence.

Line 289 : 28,8814.698-ha

Line 228 : please explain how the model assess which is the most important variable

Line 379 : define ES here and in the figure 13

Line 456. « **T**raditional » (Upper case)

Line 489 : « from 2012 to 2019 » → correct with 2020