Natural Hazards and Earth System Sciences Discussions

Nat. Hazards Earth Syst. Sci. Discuss., referee comment RC1
https://doi.org/10.5194/nhess-2021-174-RC1, 2021
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Comment on nhess-2021-174

Anonymous Referee #1

Referee comment on "Environmental factors affecting wildfire-burned areas in southeastern France, 1970–2019" by Christos Bountzouklis et al., Nat. Hazards Earth Syst. Sci. Discuss., https://doi.org/10.5194/nhess-2021-174-RC1, 2021

The paper entitled: "Environmental Factors Affecting Wildfire Burned Area In South-Eastern France, 1970-2019" investigates the spatiotemporal evolution in burned area over a 50-year period (1970-2019) and its interactions between topography (slope inclination and aspect) and vegetation type in south-eastern France by exploiting Geographic Information System databases.

I think this paper has a great potential for the large dataset of mapped burned scars; but authors don´t take advantage of this long temporal fire geodatabase. I think this paper is very simplistic mainly because of authors only show a descriptive analysis of the burned area frequency in different topographic features and vegetation types. This paper doesn´t make any scientific contribution in its current form. Following, I propose several statistical approaches to improve this paper:

- i) Frequency analysis should be carried out using more appropriate statistics as the Resource Selection Indices (please see Moreira et al. 2009; Moreno et al. 2011; among others):

Moreira F, Vaz P, Catry F, Silva JS (2009) Regional variations in wildfire susceptibility of land-cover types in Portugal: implications for landscape management to minimize fire hazard. International Journal of Wildland Fire 18, 563–574. doi:10.1071/WF07098

Moreno, J. M., Viedma, O., Zavala, G., & Luna, B. (2011). Landscape variables influencing forest fires in central Spain. International Journal of Wildland Fire, 20(5), 678-689.

- ii) Trends could be assessed by a Man-Kendall Trend analysis, for example. Changes in the burned area time series could be assessed by breaking points or Pettit analysis. Here there are some examples:

Urbieta, I. R., Franquesa, M., Viedma, O., & Moreno, J. M. (2019). Fire activity and burned forest lands decreased during the last three decades in Spain. Annals of Forest Science, 76(3), 1-13.

Moreno, M. V., Conedera, M., Chuvieco, E., & Pezzatti, G. B. (2014). Fire regime changes and major driving forces in Spain from 1968 to 2010. Environmental Science & Policy, 37, 11-22.

iii) Spatial patterns Analysis in a GIS: spatial clustering (k- Ripley), Getis-Ord index, spatial autocorrelation…

- iv) Size patterns: Gini index
- v) Geographically Weighted Regression to assess the role of the different topographic and vegetation factors over time. These models could be carried out at decadal scale to see the different role of those independent variables. See for example:

Nunes, A. N., Lourenço, L., & Meira, A. C. (2016). Exploring spatial patterns and drivers of forest fires in Portugal (1980–2014). Science of the Total Environment, 573, 1190-1202.

There are some typographic errors over the paper.

SPECIFIC COMMENTS

In introduction other several references could be included to support many sentences. Overall, the objective of this paper is to assess temporal changes in BA spatial patterns but there is not any reference about this topic.

Please see: Viedma et al. 2018 although it is related to fire number (fire frequency).

Viedma, O., Urbieta, I. R., & Moreno, J. M. (2018). Wildfires and the role of their drivers are changing over time in a large rural area of west-central Spain. Scientific reports, 8(1),

1-13.

For example, to support this sentence:

"Among the environmental characteristics, several studies provide evidence of spatial patterns relating topography to forest fire probability (Dickson et al., 2006; Padilla and Vega-García, 2011)"

Please, read and include this paper: Viedma, O., Urbieta, I. R., & Moreno, J. M. (2018). Wildfires and the role of their drivers are changing over time in a large rural area of west-central Spain. Scientific reports, 8(1), 1-13.

To support this sentence:

"Csontos and Cseresnyés (2015) observed an exponential velocity increase in upslope fire spread with the increase in slope inclination whereas downslope fire spread velocity was unaffected by slope angle and was similar to rates detected on flat terrain"

Please, read and include these papers:

Viedma, O., Quesada, J., Torres, I., De Santis, A., & Moreno, J. M. (2015). Fire severity in a large fire in a Pinus pinaster forest is highly predictable from burning conditions, stand structure, and topography. Ecosystems, 18(2), 237-250.

Viedma, O., Chico, F., Fernández, J. J., Madrigal, C., Safford, H. D., & Moreno, J. M. (2020). Disentangling the role of prefire vegetation vs. burning conditions on fire severity in a large forest fire in SE Spain. Remote Sensing of Environment, 247, 111891.

To support this sentence:

"…and the probability of large fires in landscapes with dense shrublands is greater than in forested ecosystems in the Mediterranean basin (Moreira et al., 2011; Ruffault and

Mouillot, 2017)."

Please, read and include this paper:

Urbieta, I. R., Franquesa, M., Viedma, O., & Moreno, J. M. (2019). Fire activity and burned forest lands decreased during the last three decades in Spain. Annals of Forest Science, 76(3), 1-13.

Here, authors showed that treeless areas tend to burn more than treed areas in Spain during the last decades.

To support or enlarge this sentence with the trends during the last decades:

"…broadleaved forests are usually less prone to burning than coniferous species which present a greater fire hazard (Moreira et al., 2009; Oliveira et al., 2014)."

Please, see Urbieta et al. 2019: In Spain oak forests are burning more than conifers in the last decades.

There is a great confusion with the cell size of the grid to extract the frequency data. For example, in Lines 124: *"A 500x500 m grid was created and overlaid on the study area in order to measure the percentage of the area that was burned inside every 25 m cell for each year"*. Later, author say that each cell is 25 ha but a 25 x 25 m cell is 625 m^2. Sorry, but I don´t understand anything. Please, clarify this.

On the other hand, it is said that "…*BA by vegetation type used the CLC layer closest to the BA data*"

Please, be careful because the dates of the LULC maps were not before of several forest fires and we expect that you have checked that the LULC represented by the maps always indicated prefire vegetation.

In fig. 5 and later over the paper, you use the term "fuel type". Please, change it by forest type or vegetation type or even Land cover type; because you are not working with fuel types, but only with land covers.

Please, improve the quality of fig. 6 and others done in Excel. Remove internal lines of the plot and be careful with the borders of the figure. Letters in black better than grey.

This paragraph must be in discussion section, not in results:

"Overall, the patterns described here are coherent with known interactions between fire ignition, vegetation continuity, and wind speed: fire ignition occurs most frequently in proximity to human activities (Badia et al., 2011; Chas-Amil et al., 2013; Jiménez-Ruano et al., 2017; Lampin-Maillet et al., 2011) and BA depends on fuel continuity and wind speed (Dueane et al., 255 2015; Fernandes et al., 2016). "

This sentence reflects one of the limitations of this paper:

Line 265: "However, on the northern shore of the Mediterranean, there are generally more S-facing (sum of SW, S, SE) than N-facing (sum of NW, N, NE) slopes, and BA distribution may therefore be a simple reflection of area rather than susceptibility to burn. "…"In order to compensate for this, BA is plotted as a percentage of the burned forested slopes"

As you say, this is a limitation and other type of statistical analysis should be carried out as the resource Selection Index:

See this paper: Moreno, J. M., Viedma, O., Zavala, G., & Luna, B. (2011). Landscape variables influencing forest fires in central Spain. International Journal of Wildland Fire, 20(5), 678-689.

Resource selection index (RSI). The RSI is commonly used in studies of habitat selectivity by animals (Manly et al. 1993). We used Savage's (1931) forage ratio: Wi=Ui/Ai. The index is calculated as follows for LULC types (similar calculations were made for the other variable): Ui designated the area of LULC class i burned by each fire divided by the total area of that fire, and Ai represented the area covered by LULC class i in the entire study site divided by the total area of the study site. A class with a burned area proportionate to its availability was thus represented by the value Wi=1, a class with a burned area exceeding that expected by chance (i.e. 'selected' by a fire) had a value Wi > 1, and a class with a less-than-expected burned area (i.e. 'avoided' by a fire) had a value Wi < 1.

There is confusion in the figure numeration:

It is not figure 9 but figure 8. The same with figure 10 in line 261 (it is figure 8)

To support this sentence and make comments in discussion section:

Below 30°, there are no clear differences between slope inclination categories. Above 30°, the percentage BA drops abruptly. Temporal fluctuations of the distributions show a general shift from high inclination slopes (40° or greater) to lower inclination slopes (≤20°).”

Results are like those found in Viedma et al. 2018: a shift of fire frequency to flatter areas.

See: Viedma, O., Urbieta, I. R., & Moreno, J. M. (2018). Wildfires and the role of their drivers are changing over time in a large rural area of west-central Spain. Scientific reports, 8(1), 1-13.

Please reconsider to change the figure caption of figures 12 and 13. I propose these:

Fig. 12. Percentage of burned vegetation according to the area of vegetation types by decade

Fig. 13. Percentage of burned vegetation according to the total burned area by decade