

Within this document, we respond to the comments of the reviewers. The structure is as follows:

Reviewer's comment in **black**

Our response to the reviewer's comment in **blue**

The added points/corrections applied to the manuscript in **red**.

Reviewer #3

General comments

I consider extended assessment to be approximately one-year post-fire, to coincide with the peak of the following year's green-up. It seems like too broad a range to use the definition of 2-12 months post-fire, unless the fire occurred in spring and thus peak green up followed shortly thereafter. In that case, pre-fire imagery should be used from the previous year's growing season. Perhaps it would be sufficient to add more explanation of the difference between rapid, initial, and extended assessments, in addition to pure timelines, such as what each assessment attempts to capture and represent. This might fit well after line 57 in the introduction.

We thank the reviewer for this comment. The following has been added to the manuscript following line 57:

Beyond timeline differences, each assessment captures distinct stages of burn severity. For instance, delayed mortality and survivorship of vegetation are generally undetected during rapid assessment. Vegetation may still be senescent, stressed, or dying at this stage leading to under- and/or overestimation of burn severity. Exclusively, burn severity estimation during rapid assessment is normally performed to assist post-fire responses to large fires. However, during the rapid assessment, the influence of environmental responses to burn severity is minimized. Estimates obtained during the initial assessment are considered as the first opportunity to have a complete ecological evaluation as for instance, some signs of delayed mortality and survivorship of vegetation can be slightly detected during initial assessment while vegetation may still be senescent. During the extended assessment, environmental responses are the most influential on burn severity estimates while vegetation survivorship and delayed mortality are more easily detectable, and vegetation has normally returned to their stress-free green state. Overall, burn severity estimates obtained during the extended assessment are normally considered suitable as the final reference (Key, 2006).

Related to the above, your definition of burn severity could be more clearly framed throughout the paper. Because burn severity can refer to fire effects from immediate to one or even multiple years post-fire, it's important to define what your goals are and what your end product is representing.

We thank the reviewer for this comment. Our main objective was to provide estimates of the immediate fire impacts as our end product. However, due to the limitations of RS satellite imagery availability, we had to increase our sampling period to ± 110 days. This point is now added throughout the manuscript as follows:

In Introduction section in line 130 the following has been added:

Thus, the main objective of this study is to create a high resolution multidecadal burn severity atlas for mainland Portugal entitled "Portuguese Burn Severity Atlas" — aimed at providing estimates of immediate fire impacts.

In 2.4 sub section entitled "RS imagery sampling period" line 259:

To address these issues, along with the objective of estimating the immediate fire impacts, we set our test sampling periods as follows: one day to 120 days...

I disagree with the approach of averaging all dNBR values for an area which burned more than once. Assuming a long time had passed since any prior fire, it would make more sense to represent the severity of the first fire. On the other hand, if the area is adapted to frequent fire, the severity of most recent fire entry might be more relevant. However averaging yields a value that does not represent the effects of any fire event and is thus ecologically meaningless.

We thank the reviewer for their comment. We agree with your observation regarding the limitations of averaging dNBR values in areas that burned multiple times. For this reason, we have provided all annual severity maps in their absolute (non-averaged) form within the atlas. The averaged burn severity map shown in Figure 2, panel a, was included solely for illustrative purposes — to provide a high-level overview of general burn severity patterns across Portugal over the nearly 40-year study period. This map does not appear in our final atlas and is not intended to represent the burn severity of any specific fire event. Instead, it serves to offer visual context within the manuscript, supporting the broader temporal scope of our analysis.

I would suggest giving more context on vegetation types and historical fire regimes in the introduction if possible. This is very helpful when it comes up in the discussion but would be nice to have a general sense of earlier on, especially for readers not super familiar with fire in Portugal.

We thank the reviewer for their comment. The following is inserted in the introduction in lines 121-125.

To the best of our knowledge, detailed long-term estimates of burn severity are missing for European countries, such as Portugal as the most “fire-prone” country in the European Mediterranean basin (Oliveira et al., 2011). Portugal is characterized by Mediterranean-type climate (Ermitão et al., 2023; Parente et al., 2023), a “drought-driven” fire regime (Pausas and Fernández-Muñoz, 2012), and dominated by shrubs and pines, eucalypts, and evergreen oaks forests (Fernandes et al., 2016). During the past decades, Portugal has been significantly affected by fires, such as catastrophic fires in 2003, 2005, and 2017 (Nitzsche et al., 2023; Beighley and Hyde, 2018). Thus, the main objective of this study is to create a high resolution multidecadal burn severity atlas for mainland Portugal entitled “Portuguese Burn Severity Atlas” — aimed at providing estimates of immediate fire impacts.

Line by line

We thank the reviewer for their specific corrections. All of the following corrections are applied accordingly.

Line 27 “climatic”

Climatical has been converted into climatic.

Line 48 add fuels, ie “changes on soil, vegetation, and fuels”

It is added.

Line 53 “ash removal”

“ashes wash off” is now changed into “ash removal”

Line 115-119 don’t need quotation marks

The quotation marks are removed.

Line 134 does “fire date” refer to the start or end date of the fire? Or perhaps both, to fill in the Sdate and Edate values. Are progression data generally available?

The progression data are not provided by the forest service of Portugal (ICNF) and we only have access to date of alert and containment date of fires, which we converted to Sdate and Edate. After our analysis, we understood that the recorded Sdates and Edates were not accurate specifically for fires prior to 2000 and we applied additional measures to correct them. In this line, fire date corresponds only to Edate. We updated this line to the following:

... which correspond to a band representing the day of year closest to the Edate of each individual fire.

Line 231 subject missing from sentence “in this case, ____ corresponds to images overlapping...”

Here, the missing subject was “IC” which is now added. Hence the sentence is updated as follows:

In this case, IC corresponds to images overlapping...

Line 265 confusing grammar, missing something in this final sentence of the paragraph?

The sentence is changed to the following:

From the found correlation and adaptation of our sampling period, a function represented in Eq. (1) was developed to calculate “SUITABILITY” property, which penalizes potential RS images based on their time lag —assigning values from 100 (for an image with a 0-day lag) to 0 (for an image with a 111-day lag).

Line 470 “imaging” rather than “imagining”

We thank the reviewer for this comment. We converted “imagining” to “imaging”.

Line 548 double negative, remove “no” or “neither”

We removed “neither”.

Line 597-8 I suggest clarifying here the timeframe within which this finding is true (+/- 120 days).

The sampling period applied to create Portuguese Burn Severity Atlas is now mentioned in this sentence as follows:

With 97 % of burn severity estimates of valid fires from 1984 to 2022 within the sampling period of ± 110 days, we can ...