

Response to Reviewers

Manuscript Title: *The 2022 Drought Needs to be a Turning Point for European Drought Risk Management*

Authors: Riccardo Biella et al.

We are sincerely grateful to the Editor and the Reviewers for their time and thoughtful assessment of our manuscript. We highly appreciate the constructive and encouraging comments, which have greatly contributed to improving the clarity, structure, and potential impact of our study.

The reviewers' feedback helped us strengthen our framing, sharpen our argumentation, and improve both methodological transparency and editorial consistency. We have revised the manuscript accordingly, and we provide below a detailed point-by-point response. All reviewer comments are reproduced in italic, followed by our response in regular text. Where applicable, we have included line numbers referring to the revised manuscript with annotations.

Reviewer 1

We thank Reviewer 1 for their highly encouraging feedback and for acknowledging the scientific and practical relevance of our study. We particularly appreciate the recognition of the value of combining quantitative and qualitative data and the policy-oriented nature of our findings. We respond in detail below to the comments raised.

General Comment

This is an interesting paper, exploring a very important topic with applied research, bringing together quantitative and qualitative research on European drought management through the study of a recent drought in Europe (2022). The paper is well written and the content, findings, discussion and recommendations are of value to both academia and practitioners.

We are grateful for this positive assessment, which affirms the core objective of our work: to provide an empirically grounded, policy-relevant analysis of drought risk management based on the extreme 2022 drought event. We have revised the manuscript to further improve clarity, consistency, and policy relevance based on your detailed comments below. All references to changes in specific lines correspond to the line number of the “track changes” document.

Comment 1: European Drought Directive and regional disparities

You state “we advocate for a European Drought Directive...” but your results show significant regional disparities... It might be worth also caveating more this somehow?

We fully agree with this observation. While we support the idea of a harmonized European framework, we recognize the importance of allowing for regional variation in drought impact and management capacity. We have therefore clarified this in both the Introduction (Line 201-203 and Line 257) and Recommendations (Line 939) by explicitly stating that a European Drought Directive should balance harmonization with flexibility for regional adaptation needs.

Comment 2: Abstract – mention of observational data

In your data & results you also include observational data analysis... it might be worth mentioning this quantitative/meteorological data analysis in the abstract...

Thank you for pointing this out. We have revised the abstract to include the use of meteorological data, explicitly noting our application of the Standardized Precipitation-Evapotranspiration Index (SPEI) to assess drought conditions.

Comment 3: Reference inconsistency in abstract

The paper referred to in the abstract has a different title than the one mentioned in lines 88–89.

This was an oversight on our part. The reference has now been corrected throughout the manuscript.

Comment 4: Clarify countries

Perhaps just list a few example countries in the statement somewhere to help provide this context to the reader?

We have now included the countries that introduced restrictions during May–July 2022 according to the sources presented in that section. This change appears in Line 89.

Comment 5: Inconsistent reference formatting

Line 94: IPCCa – should this actually be IPCC, 2022a...?

We appreciate this catch. We corrected the formatting of these references in both the text and the reference list.

Comment 6: Remove extra bracket

Corrected as suggested.

Comment 7: EC Flood Directive year inconsistency

Was the Flood Directive established in 2007 or 2008?

We have verified and corrected the year to reflect consistent and accurate information (2007).

Comment 8: Clarify spatial extent and time range of SPEI data

We have now included a brief description of the CRU dataset, including its spatial resolution and temporal range (1950–2022), in Section 2.1 (Lines 278 – 283). We also justified the use of the 1971–2000 reference period in Lines 284 – 288.

Comment 9: Typos and formatting

Lines 224, 289, 330, 341 (old file) – Typo corrections requested.

We corrected all identified typos in these lines.

Comment 10: Figure references and figure details

Please signpost to specific figures and clarify time scales/definitions.

We have clarified the accumulation period for SPEI in Figure 4, now clearly labelled as SPEI-6, and reversed the order of the months as requested.

Comment 11: Reorganize Section 3.1.2

Consider merging or repositioning Section 3.1.2

Following your suggestion, we have moved and merged the paragraphs into a new subsection titled “Observed and Perceived Change in Drought” prior to Line 445.

Comment 12: Figures 5 and 6 – clarify legends and colour schemes

We have updated the caption of Figure 5 to explain white areas (no impacts) and revised the colour scheme of Figure 6 to better represent impact severity (see caption and figure).

Comment 13: Figure 7 and associated text

Clarify panel definitions, address 2% vs. 27% typo, low response rates, etc.

We corrected the typo to 27% (Line 540), clarified the meaning of panels a and b in the caption to Figure 7. The differences between the classification of the responses was also clarified.

Comment 14: Length of captions for Figures 8 and 9

Captions were shortened and harmonized in style. Redundant details about the survey response format was removed (see Figures 8 and 9 captions).

Comment 15: Catalonia case study – strengthen links to data

Can more of the responses from this region be explored...?

Yes. We significantly revised Section 3.4.1, explicitly linking Catalonia’s drought onset to meteorological indicators (SPEI-6) and added detailed insights from local responses while bringing the length and structure of this section in line with the other spotlight case. We also stated the criteria for case study selection in Lines 659-663, emphasizing Catalonia’s and Italy’s relevance due to high number of impacts, sufficient data, and institutional diversity.

Comment 16: Boxed quote in Discussion

Integrate into text and rephrase question contextually.

We reformatted the quote as part of the narrative and added clarifying context using brackets (Section 4.1.3).

Comment 17: Referencing in Section 5.2

We ensured that referencing in this section is now consistent with journal style.

Comment 18: Conclusion – summarize key drought features

As suggested, we now begin the Conclusion with a short summary of the key characteristics of the 2022 drought, reinforcing its significance for European drought policy.

Reviewer 2 – Christian Massari

We thank Dr. Massari for the thoughtful and positive comments throughout the review. We are especially grateful for your recognition of the value of combining empirical evidence with drought governance frameworks, and for the detailed suggestions that helped us significantly improve the precision and clarity of our methodology and conceptual framing. Below, we provide detailed responses to the comments made.

Comment 1: Writing consistency and length

Some sections would benefit from improved clarity, cohesion, and editorial refinement...

Thank you. We undertook a full language and structural review to improve consistency. Several sections were shortened or restructured to enhance clarity, including Section 2 and Section 3.

Comment 2: Define key terms early

I recommend defining terms like drought risk and drought impact earlier...

We agree and have added clear definitions of drought risk and drought impact in the first paragraph of the Introduction.

Comment 3: Summary table of EU directives

As suggested, we created Table 1 (Line 236) that summarizes the Water Framework Directive, EC Communications (2007, 2012), and the Floods Directive — including legal status, scope, and relevance for drought governance.

Comment 4: Rename Section 2.1 and improve clarity

The section is now titled “Climate Data and Drought Assessment”. We improved the drought definition, adding SPEI threshold values (Lines 265-268), and described the CRU dataset, including the use of PET (Lines 277-283). We also clarified that PET is from pre-calculated CRU outputs.

Comment 5: Regional vs. national focus

Why center analysis on countries, when drought is a transboundary issue?

This is an important point. While drought is indeed transboundary, drought governance (e.g., plans, declarations, restrictions) is largely enacted at the national scale — making country-level analysis essential. Hence, we believe that as the focus of the study is on drought risk management, the country level information is key. However, we recognize that our current description of the regional averages may cause some confusion. Therefore, we clarified how regional aggregation was performed in Lines –343-354).

Comment 6–8: Editorial clarity, citation adjustment, sentence rewording

We have improved clarity, and relocated the citation of Avanzi et al. (2024) to Line 399, where it fits the narrative better.

Comment 9: Clarify case study selection

We now clearly state why Spain (Catalonia) and Italy were selected (Lines 659-663), based on the many impacts and impact severity, data sufficiency, and institutional variation. We also highlight how these cases illustrate broader themes from the survey.

Comment 10: Decentralization and governance systems

We expanded our discussion of governance systems in Lines 192-194, suggesting that decentralization might play a role in preparedness and coordination.

Comment 11: Simplify Figure 6

As advised, we have simplified Figure 6 to show only panel (a), focusing on impact severity. Prioritization results have been moved to a new Supplement Table S2. We also clarified the basis of the regional averages (Lines 29-342).

Final Statement:

We thank both reviewers again for their valuable and constructive feedback. The manuscript has been significantly improved as a result. We hope that the revised version meets your expectations and look forward to your final decision.

With kind regards,
Riccardo Biella
On behalf of all co-authors