

Reply to reviewer 2

We would like to thank the reviewer for valuable suggestions and comments. In this document, we reply to each of these. L refers to the line number. For example, **L65-70**, refers to lines 65-70.

Reviewer 2		
1	<p>This study shows an assessment of flood risk using a multi-criteria GIS-based approach incorporating wildfires and floods for the Ebro basin. The study tackles an important topic; it is a generally well written and well-argued paper, with a strong narrative and clear structure.</p>	<p>We would like to thank reviewer for the acknowledgement of the importance of the topic and the clarity of the paper.</p>
2	<p>At points in the paper, some terms are used somewhat interchangeably and not always defined. For example, in the title the authors use “effects”, then later “impacts”, then a mix. Similarly, what is meant by a cascade in this paper? Is it a cascade in terms of a trigger or something that increases risk (i.e. a mechanism or process that links these two hazards even if temporally), or a cascade in terms of impacts, or both? I feel as those terms are being used somewhat interchangeably in this paper.</p> <p>For example, in L12 in the abstract, the authors say “...especially when considering the cascading impacts of wildfires”. I would question here what the cascade is? Or indeed, whether this is an impact? To me, this perhaps is more of knock on effect or something that increased the risk of something else through changing vulnerabilities (as the authors note later on) – a wildfire affects the flood risk through burnt area and so forth, which in turn may cause impacts for example – but is this process an impact? I would suggest that clearly defining these terms and then staying with them throughout would benefit the understanding for the reader.</p>	<p>We thank the reviewer for raising the terminology used in the paper. We agree with the reviewer and decide to use the term effect instead of impact. Moreover, we will provide the definition of cascading used in the manuscript, which is triggering or amplifying the flood risk. We will change this term throughout the revised manuscript.</p>
3	<p>The abstract mentions indicator only once, but a large part of the study is actually focused towards the integration of socio-economic indicators and land-use change information with ‘conventional’ hydrological properties and the cascading effects of wildfire to assess flood risk. This is a complicated endeavor within a multi-hazard/multi-risk approach, which is good to see, but I think the fact that this is approach should be made much clearer in the abstract and title so it is clear that the story is not solely about the cascading effects of wildfires and flood, it is more about better flood risk</p>	<p>The referee has a valid point regarding mentioning indicators. In the revised version, we will elaborate more in the indicators used in the study. Moreover, we will also expand the abstract highlighting the multi-hazard/risk approach and how this could be done for better flood risk assessment.</p> <p>We thank the reviewer for the suggestion on the title and for stressing out the multi-hazard/risk instead of cascading. We will revise the title and abstract accordingly.</p>

	<p>assessment as a whole, incorporating wildfires.</p> <p>Later, in section 4.3 in the discussion, the authors state “Therefore, this research provides an example of how to integrate multiple hazards into risk evaluation by conducting comprehensive assessments that consider numerous drivers and indicators that will contribute to increased flood risk in the future.” – this is a, I believe, a better (more correct?) framing for the study. I would suggest multi-hazard/risk be included in some way in the title, perhaps even removing the word cascade, and a reduction on the focus of the wildfire and flood cascades and more towards flood risk using multiple inputs from the start.</p>	
4	<p>The methods are comprehensive but section 2.2 is framed around flood risk indicators, however here this is where wildfire risk and indicators (FWI for example) is employed. Related to my point above, this section to me should be given a clear multi-hazard focus towards flood risk to make it clear that fires are part of this. Some subtle reframing and – importantly – including wildfire in the subtitle may be beneficial to guide the reader.</p>	<p>We thank the reviewer for the suggestion. We will reframe the context of the article toward the focus of multi-hazard/risk. We will modify the heading of chapter 2.2 into “Indicators for flood risk assessment including wildfire risk”.</p>
5	<p>The use and placement of the equations based on expert judgement FR, FEI etc is very confusing. FR is at the end of the methods section but if not defined until section 3.4. Then, additional equations, such as FVI, appear later on. Lines 213-4 says “This process allows us to calculate the Flood Hazard Index (FHI), the Flood Exposure Index (FEI), and the Flood Vulnerability Index (FVI), as denoted by Equation 1”, however equation 1 shows the equation for FR. Equations 2 and 3 are not referenced from the text. Some terms, such as FS, are really hard to find the definitions of (one has to go looking in the text), and no units are provided. The use and presentation of these needs a rethink.</p> <p>I would suggest that the equations are all placed in the methods and defined there, leaving the results to focus on the weighting by expert judgment and, therefore, the outcomes of the study. Indeed, many of the sub-sections 3.3 and 3.4 for example, stray into methods rather than results. Some careful reordering would really help the readability and accessibility.</p>	<p>The reviewer expresses concern about the use of equations based on the expert judgement and the structure of the results. Indeed, we place the results of FR in chapter 3.4 because FR cannot be calculated without knowing the FHI, FEI, and FVI values beforehand. This is the reason that we describe the results of FHI (chapter 3.1), FEI (3.2), and FVI (3.3) first. In the method, we present the main formula of calculating the FR, which consists of FHI, FEI, and FVI components. We will provide all the flood risk component formulas in the chapter 2.5 when we revise the paper, including their full names (not abbreviation). In addition, we will provide a short paragraph in between chapters 3 and 3.1 explaining the structure of the results.</p>
6	<p>Related to my above point, there is a large emphasis on expert judgement of the</p>	<p>We thank the reviewer for the feedback. We will provide the results of AHP in the</p>

	<p>indicator weightings. It is not clear though quite how much emphasis they have on the results. Is seven people enough? Are they all from the Erbo region? Does this matter? The earlier phases of the study are quite analytical, but then the focus moves to a judgement based approach. Additional details on this process, perhaps in section 2.5, would in turn help understand and interpret the later results section.</p>	<p>Supplementary Information. Moreover, the background of the experts will be provided in the chapter 2.5 in the revised version. Indeed, we only managed to interview seven experts although we sent interview requests more than seven. Some experts declined with various reasons and even one of them does not agree with the multi-risk framework that we formulated for the study. We will discuss the limitation of only interviewing seven experts in the revised manuscript.</p>
7	<p>The discussion is good and very readable. It provides some excellent additional information. I do think though that perhaps a bit more work may be needed to separate the location-specific findings based on local expert judgement and the wider findings that can be employed elsewhere. The authors don't really attempt to do this; instead the assumption is that the results shown here for Erbo would hold elsewhere. This localised expert judgement is not mentioned in the limitations in 4.4. The title at the start calls this paper a "study case" but really Erbo is the study here primarily. Making it clear that the findings for the Erbo maybe separate from broader interpretations would be beneficial in the discussion, including some detail on how this can be done (and the limitations of doing so), would really elevate this to be a usable example more broadly.</p>	<p>We thank the reviewer for the suggestion. Indeed, our study is only for the Ebro River basin. However, the approach employed in this study could be applied elsewhere as long as the data are available. The experts are not only coming from Spain but also other countries in Europe. The expert background will be expanded in the revised manuscript. We will make it clear about the applicability of our approach.</p>
8	<p>The conclusions in section 5 state "The research underscores the need for interdisciplinary collaboration..." in relation to the experts. While I agree with this statement, this is not a focus of the study and isn't presented up to this point. If the authors which to explore this narrative, this would be better placed in the discussion above.</p>	<p>The reviewer has a valid point and we will move the sentence into discussion (chapter 4.3).</p>
9	<p>Specific/minor comments:</p> <p>Line 191-2 Please clarify or reword what is meant by future wildfire effects (FWI) and the burnt area? FWI is already defined, but what is meant by effects?</p>	<p>We thank the reviewer for spotting typo. Here we meant future wildfire effect, indicated by FWI.</p>