Interactive comment on "Hydrological threats for riparian wetlands of international importance – a global quantitative and qualitative analysis" *by* Christof Schneider et al.

Anonymous Referee #3

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The authors aim to address an important issue: Identifying Ramsar riparian wetlands that exhibit current and future variations in ecologically consequential inundation patterns as a result of human-modified flows (e.g., dams). They ask three particular research questions to best identify these wetlands. These questions focus on the impact of current water resource management on riparian wetland flows, the effect of future climate change on inundation of these wetlands, and the implications of low government and societal infrastructure and capacity to make changes to future management.

The goal and research questions the authors attempt to address are broad and could be impactful if addressed and translated well. However, a major revision is required to ensure both the quantitative work behind the research and the communication of this

work is effective. Below, I provide major suggestions for the manuscript followed by some general comments.

Major Point 1: The Introduction reads somewhat like a full literature review that continues for quite some time without a direct point. It was well into the sixth paragraph that the goal and research questions were stated. I would suggest tightening up the Introduction, providing only key points throughout, and early on (perhaps at the end of the first paragraph) allude to the main point of the paper (e.g., "We aim to..."). Then, the authors can safely state the full objective and research questions at the end of the Introduction.

Major Point 2: Something is very misleading and incorrect about discussing a "natural" flow regime in knowingly modified watersheds and aquatic systems. Also, the word "natural" is used throughout the Abstract and Introduction (ala Poff et al. 1997), and it is not until the Methodology that authors define natural flow. The authors describe natural flow for this paper as "simulated taking into account current climate and land-cover conditions, but no further anthropogenic impacts." This, by no means, would constitute a "natural" flow regime as described in past literature. I would recommend modifying terminology and the discussion throughout the paper to consider this as your "baseline" flow regime from which the analyses aims to understand current water resource management implications on the riparian wetlands and project changes of these regimes due to climate change

Major Point 3: The goals of the paper and research questions are poorly worded need more information. What, specifically, are the "riparian wetlands?" In the Abstract, the authors suggest they look at 93 Ramsar sites. Are the "riparian wetlands" the "93 Ramsar riparian wetlands?" For Research Question 1, why are 6025 dams selected? Are these dams specifically located upstream of Ramsar riparian wetlands? What are the "different water use sectors"? Also, delete "Thereby" at the beginning of the second sentence. For Research Question 2: "Inundation" cannot be "impaired" because "inundation" does not necessarily denote a positive quality. The authors could replace

"impaired" with "exacerbated or diminished" or "modified." Also, delete "Therefore" at the beginning of the second sentence. Research Question 3 is stated in a grammatically incorrect way, so it took a few re-reads to understand it. Move "could" after the word "sites." Also, what is a "low capacity to act?" This is definitely not clear.

Major Point 4, WaterGAP3 runs: Streamflow, for what the authors term "daily natural flow regimes" (1981-2010), is simulated with 2004 land cover. Using 2004 land cover is okay; however, going back to the use of the word "natural"...how can this be considered natural flow when the landscape for each area is likely highly modified and streamflow is a reflection of these anthropogenic activities? Also, there is no mention of calibration and verification of the model, which admittedly would be difficult a global scale. Therefore, is the entire paper a thought experiment using an uncalibrated global model to help explore hypotheses? It would be okay if so, though this framework should be characterized as such throughout the paper. Also, the results (maps, in particular) should emphasize the paper's overarching approach (i.e., the thought experiment – a "screening tool" is mentioned in the Discussion, hypotheses testing, and/or a conceptual model). If calibration and verification did occur at some stage and is not referenced, again, measured streamflow would reflect the managed conditions, not some unattainable "natural" or "near natural" condition. The model scenarios are therefore a bit confusing and need some rethinking, definitely in the presentation of what they are but potentially in which ones should be used. For example, consideration should focus on whether only the managed scenario and future climate/management conditions should be used since the true "natural flow regimes" aren't captured.

Also, the authors talk about the database of dams that are used, but how does that relate back to the Ramsar wetlands? Are these dams all upstream of Ramsar wetlands? As I read on, it became a bit clearer that this is simply a global database, and Ramsar wetland areas within the global domain are analyzed. However, this information (spatial domain and selection of dams) needs to be clearer up front.

The authors likely have all the information mentioned in this Major Point. There is

simply a need for better and clearer communication regarding these bits of information. As a result, the Methodology section seems quite disjointed and leaves the reader guessing at how the authors conducted the analyses.

Major Point 5, Discussion and Conclusions: Be careful here. Because this is thought experiment using a global model (again, unless calibration/verification happened but wasn't mentioned), your conclusions need to be balanced with a statement of the conceptual aims of the paper and associated limitations/assumptions. The quantitative analyses isn't incredibly quantitative, and I wince a bit with the use of numbers like "8 % are significantly impaired" and flood volume is likely to be decreased at 41% of the sites..." when those are all relative numbers with no basis in reality. Please mention up front in the conclusions or make a separate section of the limitations and assumptions with regard to what the analyses can actually provide.

Major Point 6: In general, the English is okay as written. However, it's important that someone extremely proficient in English re-review this paper for odd placement of verbs, adjectives, modifiers, etc., and poor word selection. One small example, on Page 5, Line 14 "For Europe, a higher number of sites "were gained" as the European wetland geodatabase...". This should be "were selected" or "were chosen". There are many instances like this throughout the paper, and I do not list them all below.

Specific Comments

Page 1, Line 9 – Recommend changing all references of "mankind" to "humankind" and "man-made" to "constructed"

Page 1, Line 9 – These eco services are provided not only via the regular patterns of inundation but also regular patterns of drying – so actually, it's the *variability* inundation patterns that is important.

Page 1, Line 26 – Need to review and add Dixon et al (2016) as well. Dixon, MJR, Loh J, Davidson NC et al. 2016. Tracking global change in ecosystem area: The Wetland

Extent Trends index. Biol. Conserv. 193: 27-35.

Page 2, Lines 18-19 – Is this true for all "larger cities?" What spatial scale is this referring to? Are these global or regional estimates? If regional, what regions?

Page 2, Line 25 – Again, what are "natural sites?"

Page 2, Line 30 – Not all floodplains are wetlands, which is how this sentence reads. Please correct.

Page 2, Line 32 – What ecological processes are initiated? Some of these processes may be initiated by drying not wetting.

Page 3, Line 2 – What is engendering what? This clause doesn't make sense.

Page 3, Line 4 – That's a very broad statement, that all floodplain wetlands contain more species than any other landscape unit. Need more specifics here because it's likely not what the authors intended to say.

Page 3, first paragraph – The Roman numerals are not needed when providing full sentences after them. Suggest removing all Roman numerals here.

Page 3, Line 24 - What are "fellow riparians?" Please be more specific.

Page 3, Line 25 – What projections? Please be more specific.

Page 4, Lines 12-16 – Break up this sentence into two or more sentences.

Page 5, Lines 19-20 – These sentences can be deleted and are unnecessary.

Page 5, Line 23 – "percent change in flood volume": from what period to what period? Please provide time frame.

Page 5, Line 28 – It is not clear at this point what "sufficient capacity to act" means. Suggest modifying this or adding some clarification here to lead the reader to the more specific methods discussion.

Page 5, Line 3 – The simulation of daily natural flow regimes would still be an expression of a modified landscape, so how are these natural?

Page 5, Lin 9 – Need clarification of what type of "daily river discharge" is being simulated here – "natural" or "managed"? (After reading on, it becomes obvious it's "natural" but that needs to be mentioned straight away.)

Page 5, Line 20 – Switched to "near-natural" from "natural" in this sentence. Please be consistent.

Page 7, Lines 6-9 – Need to be clear here why the simulation includes these specific 6025 dams. Why were they chosen? Intuition would tell me they are all upstream of Ramsar sites, but further reading seems to suggest that they are simply part of the global database. These questions regarding methods also suggest that clear summary statements of what the quantitative analyses is up front in the Methodology should be added – meaning state your steps: exact simulations, the spatial scale, how dams were selected, how the Ramsar sites were overlain on the global map, etc. Then, details can be added after this summary.

Page 9, line 14 – What selected sites? The Ramsar wetlands? Again, details are needed here.

Page 9, Lines 14-15 – This sentence is a bit wonky and needs to be reworded.

Page 9, Line 18 – How were the cutoff thresholds for Table 2 selected?

Page 9, Line 20 – Again, clarify what the "low capacity to act" is.

Page 9, Line 27 – Define blue water

Page 9, Line 30 – Again, how were the Table 3 thresholds derived?

Page 10, Lines 25-27 - Cut these sentences. Too much introduction here.

Page 11, Line 4 – These wetlands are "moderately impacted" – as far as the map

seems to read.

Page 11, Line 17 – N=2, though, correct? So this is only discussing two wetlands, right?

Page 12, Line 28 – Is this the ensemble median for the GCMs as input to the Water-GAP3 model or the ensemble average of the output of the WaterGAP3 model?

Page 13, Liens 16-17 – Now that is a very interesting finding!

Table 1, change "not/slightly" to "none/slightly" – same with the figures: "not/slightly" does not make sense.

Table 2, delete "the number of" in the caption.

Table 4, define "formal institutional capacity" in the caption to make the table stand alone.

The final edits for the paper are included in the Major Points listed previously.