Hydrol. Earth Syst. Sci. Discuss., 12, C6657–C6663, 2016
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Hydrology and Earth System Sciences
Discussions

Interactive comment on "The inbuilt long-term unfeasibility of environmental flows when disregarding riparian vegetation requirements" *by* R. Rivaes et al.

Anonymous Referee #2

Received and published: 9 February 2016

General comments

The goal of this article is to show by means of simulation modeling that environmental flows, when incorporating vegetation requirements and integrating vegetation change, reflect more realisticly the requirements of fishes, in turn being more effective in improving fish habitats. Connecting river components in such a way is a pending subject for river management, and particularly, for the implementantion of environmental flows in Europe, and therefore the article may be of high interest for readers of HESS. Relevant gaps of knowledge are exposed in the introduction, the authors look to master the method used and the existing literature and the results are generally clearly presented.

I don't know too much about the models used in this paper to judge the pertinency of the technical decisions that have been made, so I will "just" give my opinion as a riparian plant ecologist.

One of my main concerns is related to how the relevance of this work is presented. It is not enough with a paragraph in discussion acknowledging the limitations of using simulations, but the authors need to be more careful with their speech, which I found too "brave" (see examples in comments by line of discussion and conclusions).

Also, it is very important to better clarify (and soon in the paper) the meaning of the term "requirements" (or consider changing the term). It is not clear until late in the paper that the goal is not to improve environmental flows so they also promote vegetation sustainability (e.g. flows to promote recruitment of vegetation) but rather to adapt flows to clear vegetation from landforms regularly so fish habitats are improved. There is a large body of literature dealing with different environmental flows to promote vegetation recovery, restoration or simply to support viable populations, which use the term "requirements" in a completely different way than here. For example, Stevens et al. 2001 Ecol Appl Vol 11 environmental flows for removing invasive species while recovering natives, Hall et al. 2011 in Resto Ecol Vol 19 showing environmental flows to promote recruitment (and many other papers by S Rood including the seminal papers of the Recruitment Box Model). I am not too convinced this paper refers to requirements of riparian vegetation in the sense a riparian plant ecologist would understand. Instead, the environmental flows proposed in this paper suggest to truncate riparian vegetation succession regularly by promoting floods of higher magnitude regularly, and more generally, to include the effects of vegetation development on flow evacuation through the channel when calculating environmental flows for other ecosystem components. It is an assumption of this paper that vegetation will regularly establish, and implicitly, that the same kind of vegetation will establish. Different riparian plants are very sensitive to the flow and flood regime for their establishment, and the resulting plant communities may have different roughness and consequently affect the feedback loop suggested in

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this paper less deterministically than suggested here.

I also have trouble to understand how the effects of vegetation are taken into account into the habitat modeling. I am not an expert on fish habitats so I apologise if I missed something but how vegetation roughness directly affect habitats of one or another fish species by the WUA (discussed in page 10714) needs and ecological explanation.

Specific comments

Abstract Not clear in the abstract if the point of the paper is to improve environmental flows so they are also effective for riparian vegetation or as a tool to achieve more effectiveness for fishes. Line 6. Biological communities is vague. Do you mean vegetation and/or fishes? Or both? Or more communities than two?

Introduction The logic of the intro was not always easy to follow. Not clear if the goal is to make environmental flows more integrative (adding biotic components such as vegetation to achieve ecosystem integrity) or to improve the effectiveness of the environmental flows for fishes by using the other components, vegetation in this case, as a tool). I realized that the second is true only at the end of the intro because, in the three research questions, restoring the aquatic communities is the goal. This goal looks contradictory to the sentence in lines 11-14 of page 10704, that clearly states that comprehensive restoration approaches (i.e., including all river components) are necessary. All goals are legitimate, I just recommend that you state more explicitly your vision so plant ecologists that may be attracted by your title and abstract don't get frustrated. 10703 Line 24. The consensus that the flow regime is a key driver is also the result of river ecology as a scientific discipline, not strictly from environmental flow management. Both fundamental and applied research have contributed to raising the flow regime as key driver for river systems organization. 10704 Line 1. Is the "must be based" a fact or an opinion? Maybe add "ideally" because in the abstract you said that it is not always the case (not integrating vegetation requirements) Line 9. Are not environmental flows always applicable "downstream of dams"? (something different

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is that the effects of dam management also apply upstream from dams) Lines 11-12. Not need to refer to process-based restoration here (first time introducing restoration, it would need a definition of process-based). I would say simply that environmental flows, when implemented, are based on the requirements of a single group of organisms. Line 16-18. Not clear sentence. Important to develop this sentence so the gap of knowledge introduced in lines 21-24 is relevant. Line 25-26. This needs clarification. I see a contradiction here. What happens when environmental flows are originally based on vegetation? Then incorporating the needs of others groups, like fishes would be necessary. In lines 12-13, it is said that the problem is that are based on a single biological group, mostly fish, but this is an open statement. You should say more clearly as in lines 14-15 that environmental flows are biased towards fishes. If you go directly to state the problem, then you have more room to develop the consequences of this limitation, that are now only briefly explained in lines 16-24. 10705 Line 9. Efficiency for what? Line 20. Was the modeling validated with real data for each scenario? Can we use the term "validation" when talking about validation of efficiency if only models were used? I am not saying that the models are not useful but maybe this last sentence is a stretch.

Methods Maybe I have missed this explanation but why flushing floods are predicted every two years? Why the magnitude of the flood at year 10 is twice the biannual floods? It is not enough to refer to Table 1 or Fig. 2 or to the CASiMiR model. Riparian communities respond to hydrologic alterations on a time scale smaller than the year. For example, the timing (intra-annual) of floods is essential for establishment of Salicaceae species, as extensively described in the literature. Ie. Need of high floods in spring followed by stable water levels in summer and absence of scouring floods in the fall. Many have shown the importance of progressive (as opposed to sharp) water table drawdowns, etc. In fact some authors have suggested that environmental flows for vegetation recruitment may be implemented at certain years only, leaving flows for "vegetation maintenance" for most of the years. See for example Hughes and Rood 2003 Environ Manage Vol 32. 10709 Line 13. Is the natural flow regime the actual flow

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regime? Or it is a theoretical natural regime as opposed to a regulated flow regime (the real flow regime)? If the first is true, consider to change the name of "natural" with "actual". An alternative may be to show the effects of the natural flow regime and the regulated flow regime (that would show that environmental flows, even the ones not considering the riparian requirements are able to have an effect on the fish habitats), but maybe it is too late for that.

Results 10712: I am sorry but it is not clear to me where to find the results of the measurements taken on the 56 vegetation patches. The first sentence of the results would better fit into the methods section. Sentences like the one in line 28 pg 10713 (Those mean values are significantly different between all three habitats) need statistical proof (test and p-value). Same thing for line 3 of page 10714. Fig. 4. It is quite surprising that you found significant differences for depth given how similar the boxplots are.

Discussion 10715 Line 2. Not so sure about the sentence "incorporating riparian requirements into environmental flows". (I have trouble with the word requirements, it is actually vague and needs clarification: Vegetation is very happy with the situation of Eflow, requirements for recruitment are not the same as requirements for survival and forest development, or requirements for vegetation renewal...) Lines 13-17. Please be more cautious in your speech: extremely valuable ... which revolutionizes the actual paradigm in environmental flow science... 10717. Lines 18-28. Yes, this is one of my main concerns. As all this work is based on simulations. I think you need to insist more along the discussion in showing that all the results are a product of simulations. Also in this paragraph maybe say something about the situation in your study area? What is the environmental flows, if any, that are being applied? If there are some, did you have some preliminary data to confirm that your simulations are good? Do you have a plan to validate your simulations in the future?

Conclusions Better to say we demonstrated via simulations and therefore hypothesize that... could change accordingly... I think your work is equally valuable, but it is necessary to acknowledge the limitations of simulations (justified by the social context) not

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only in a paragraph in the discussion but also in your speech all along the ms. Another example of unnecessarily sharp speech is in line 14: “is thus mandatory”. Unfortunately, it is not mandatory (by law) in many world regions. Why not just saying “is a very promising tool to assure/achieve. . .”?

Technical corrections

Abstract Line 5. Replace contribute with contribution Line 10. Replace evolution with change Line 17. Replace mandatory with necessary

Introduction 10702 Line 20. I would remove “that greatly exceed the . . . Daily, 1997)” Line 23. I would say river regulation, not only rive damming. River enbankment is in my opinion even more detrimental to rivers in many ocasions. Line 25. Remove “ethical” (it is not only ethical but practical) 10703 Lines 13-16. Too long and wordy sentence Lin 17. Has been under an intense debate Lines 18 and 19. Acreman et al. 2014 is twice in the list 10704 Line 27. Remove has 10705 Lines 3-5. No need of so many refs Lines 5-8. Same thing

Methods For 2.2.2. Riparian vegetation data, the year of sampling is missing 10706 Line 25. Weird to read “to calibrate the model” before we learn about the characteristics (and even the existence) of a model (“modeling” is said in the intro but we expect the description of the model first here) or refer to section 2.5? 10707 Line 4. Same comment. Better to say “a riparian vegetation model” or refer to section 2.4? 10708 Line 23. Quadrats 10709 Lines 21-23. In the intro or here, we would need a brief explanation on why monthly discharges are important for fish requirements and why flushing flows of different interval requirements are important for vegetation. Readers don’t have to know about the life cycle of fishes and vegetation. I.e., Flushing flows are intended to erode landforms and remove vegetation (ie avoid encroachment) or to promote vegetation establishment (salix colonisation is based on the recurrent creation of landforms that are bare, open and moist, followed by declining water tables at particular rates, see Recruitment Box Model of Mahoney and Rood 1998 Wetlands Vol 18,

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and many others)? 10711 Line 28 species

Results 10712 Line 22. The field survey or The field surveys 10713 Line 21. Remove "covered" Line 24. Replace "with" with "to" 10714 Line 17. Add a "," after the first "habitat" Line 23. Replace "were" with "was" Line 24. Remove "matter of the" In Fig. 4. Caption. You need to add something as it is very confusing: Fish weighted usable areas provided by the different riparian habitats obtained by simulating three theoretical flow regimes (natural, xxx and xxx) (in better English than mine) addressing only fish requirements (Eflow). In Table 2 caption you should give a reminder on how to read these "deviation" measures, for those readers not familiar to this method

Discussion 10715 Line 5. According to three different simulated flow regimes Lines 6-7. There is something missing in this sentence: for the hydrodynamic modeling and following fish habitat availability assessment... Lines 7-10. Wordy and probably unnecessary sentence.

References The number of references is too long, sometimes the paper reads like a textbook instead that a paper (avoid those long references lists). I don't think that the journal will accept ca. 150 references in the list.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 12, 10701, 2015.