

Interactive comment on “Hydromorphological restoration stimulates river ecosystem metabolism” by Benjamin Kupilas et al.

Anonymous Referee #2

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This manuscript addresses a question of high importance – how might we use measurements of ecosystem processes to monitor the health of rivers? While there has been a push to include process measurements with other monitoring efforts (including those of restored sites), data showing how process measurements can actually be used to inform monitoring in rivers are few. Here the authors estimate ecosystem metabolism and hydromorphic characteristics of connected river reaches with ($n=2$, “R1” and “R2”) and without ($n=1$, “D”) a history of restoration efforts and provide evidence for higher rates of ecosystem metabolism (gross primary production and ecosystem respiration; GPP and ER) in restored versus degraded reaches. What this difference means in terms of “good” or “bad” rates remains unclear without longer-term before/after data. And while the motivation for this research is very timely and will be of broad interest, a few assumptions behind methods and presentation of results limit

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the impact of the manuscript in its current form.

General comments -

1. It is not clear from the descriptions in main text and supplements why the two restored reaches were separated from one another – beyond the fact that they were perhaps separate projects? While restoration effort was indeed larger in R2 than R1, it was not drastically so, especially given the larger reach area in R2 than R1. Further, using a single-station metabolism approach to estimate GPP and ER does not honor the boundaries set by the authors in naming R1 and R2 given the overlap in O₂ footprints upstream of researcher-defined reach boundaries. Based on author responses to earlier comments, it appears that combining R1 and R2 is a more suitable approach, despite losing a reach "replicate" of sorts. I hope the manuscript will be revised accordingly and the authors will confirm that combined R1-R2 rates are reasonable given what R1- and R2-only rates were.

2. Time series analyses could be a more powerful way quantify differing/strengths of controls on metabolism in R vs D reaches during the 50-day deployments. A more sophisticated analysis would enhance the contribution of the paper beyond means/ranges of GPP, ER, NEP. See Roley et al 2014 Freshwater Science for an example of this and a citation of general interest. If not used here, this is at least worth a mention for future research avenues.

3. "The importance of autochthonous production for ecosystem functioning" (19-20) is a very context-dependent statement that should be expressed with caution. What does an increase in GPP mean for ecosystem health? We see this response in the R2 reach (but D was 2nd highest in macrophytes, not R1?), and higher GPP is sometimes used as a sign of ecosystem degradation: excess primary production in response to nutrient loading. Units of N are in mg, so there may be environmental issues requiring mitigation beyond physical restoration by widening river channels. Without "pre" data for R reaches, one could argue that the restoration project provided more light + warmer

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temperatures needed for enhancement of macrophytes beyond “natural” conditions.

Line-specific comments –

2 – No comma needed after “Both”

49-50 – Should include a “but see...” citation here to acknowledge that there have indeed been several previous studies even if this issue is not well-studied or settled.

53 – Delete “only”

109 – It would be useful to give time frame of/since restoration here, not only in supplement

130 – What about water chemistry? Any differences among reaches? If restoration is indeed altering nutrient retention or removal, that should be reflected in downstream concentrations.

183-4 – Vague RE: which methods as written. Why not restate and give equations for this, k , and base metabolism calculation to allow readers to better assess the methods within the manuscript itself?

225 – Good to see that the authors will update their statistical analyses in a revised manuscript.

227 – Data from flood events are one of the most exciting things we can learn about from longer time series. I urge the authors not to exclude them from their analyses.

273 – “returned”

347 – Give some numbers to support this comparison in the main text. Fine to keep the citations/table in supplement.

369 – “near-natural” is a very vague description and does not seem to be supported with data

380 – “as a functional indicator”

Table 2 – Check units. Superscripts for m didn't appear in my version of the text.

Fig 2 – Needed? There are many figures, and I didn't feel that this was needed for main text. Supplemental figures are nice.

App S5 – Possible to include Q for context? See also Genzoli & Hall 2016 FWS, Davis et al 2012 RRA, Dodds et al. 2013 FWS, Hall et al 2015 L&O.

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