

Interactive comment on “Using high-resolution phosphorus data to investigate mitigation measures in headwater river catchments” by J. M. Campbell et al.

J. M. Campbell et al.

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Referee #2 21. P10969 18: What is a reasonable period? Did you test for it or did you use a standard time interval? Please elaborate on this. Response: Amended - please see point 7 for Referee #1, above, for amended text.

22. P10969 20: What depth is “root depth” in this study? And are all samples taken in the same depth? Please include in the text. Response: Amended – please see point 6 Referee #1, above, for amended text.

23. P10970 5-9: You mention the number of resamples, what was the reason for

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not resampling all (time? budget?), and have you thought of the potential impact this reduction of sample size could have on the results, despite the statistical analysis of the number of re-samples? Response: Clarification on rationale added. Some background research was undertaken on the robustness of taking a sample of a population of fields before the study started – there appeared to be no single advice from a number of workers and so the power analysis based on a referenced expected (reasonable) change was chosen as the most parsimonious strategy. Please see point 9 Referee #1, above, for amended text.

24. P10970 25: You use 20 min cycles, is that due to instruments settings, or have you tried different temporal resolutions to come up with 20 min cycles as the optimum? A reference to previous work could be in place here. Response: The time-stamp is set to 10mins in the analyser and the default TP cycle is every 20minutes. There are, therefore, ghost datapoints duplicated in each subsequent 10min time stamp. Averaging to one hour is necessary to smooth this data apportionment with three true datapoints included in the averaging.

25. P10971: The nutrient management plans that you mention (for instance line 27), could you elaborate a bit on that. It is not clear what these management plans include, and how they are different from before the monitoring was initiated. Response: Agreed, clarified. “Nutrient management plans were provided to farmers on a field basis and based on respective requirements for optimum grassland agriculture in each catchment and jurisdiction (equivalent to SI 31, 2014 and SRNI 488, 2006). Of the farmers participating, formal nutrient management plans were either a new concept or had been previously provided at the very coarse scale with several field blocks integrated as single land use units.”

26. P10972 10 and 18-25: You confuse the statistical term “percentile” with the percentages that are given by a Q-flow duration curve. For instance, you state that you use the percentiles to group your discharge data; however that is not consistent with the naming Q90, Q80 etc. For instance, you consistently refer to Q95 as represent-

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ing the extreme low values and Q10 as representing the 10% highest values (line 22), hence the Q95 and Q10 do not represent 95th and 10th percentiles, respectively, as you state. A percentile is a value below which a certain percentage of observations fall, so the 95th percentile represents the value below which 95% of observations fall. This confusion is also seen in fig. 6, where you present of flow duration curve which is not the same as showing percentiles. You will have to change this throughout the manuscript, including fig. 6 and table 5, so that the term percentile is correctly used. Response: Yes – we acknowledge the error and have amended throughout.

27. P10972 27: You write “climate signal” somewhat out of context, I suppose you refer to fluctuations in the annual river discharge as being a climate signal and “this metric” refers to the river discharge, or? Please elaborate/change sentence. Response: Agreed, clarified in the text. “As total annual P load is highly influenced by annual discharge (Edwards and Withers, 2007), which varies with climate (rainfall) variability, it was assumed that this metric (annual P load) would be an unreliable predictor of change if catchment mitigation strategies had influenced P in runoff in the short term.”

28. P10973 13 and 23: The text says n=66 for index 3 and above, table 16 says 59. Which one is the right one? The text says n=85 for index 1 and 2, the table says 78, which is right? Response: We acknowledge the error and have amended the text.. “On an index basis in Co. Tyrone over the five year period, the Index 1 and 2 fields showed a significant increase in mean P concentration from 16.28 to 22.24mgP L⁻¹ ($P = 0.161 \times 10^{-10}$, $n = 78$). However, when all fields with 2005 concentration > 26mgP L⁻¹ (index 3 and above) were analysed for change there was a significant 15 decrease from 41.8 to 37.7mgP L⁻¹ ($P = 0.008$, $n = 65$). When only fields with a 2005 concentration > 46mgP L⁻¹ (index 4 and above) were considered there was also a significant mean decrease from 56.0 to 48.9mgP L⁻¹ ($P = 0.045$, $n = 30$).” “Unlike Co. Tyrone, however, the higher index fields in Co. Monaghan showed an increase in mean concentration. For example, between 2005 and 2010 the mean concentration rose significantly from 46.2 to 50.7mgP L⁻¹ for index 3 and above ($P = 0.01$, $n = 59$).”

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29. P10976 15: There is no Table 6 included in the manuscript? Response: We acknowledge this – it was, however, in the original uploaded file. See point 15, Referee #1, above for Table 6.

30. P10976 26: You write that results also indicate a convergence towards optimum soil P status, this is not immediately obvious from the figures/tables, where the units are either mg L⁻¹ or kg ha⁻¹. Is convergence just in Co. Tyrone, or is it in both catchments? and is it seen on all fields? Could you exemplify with some numbers? Please elaborate on this in the text as well. Response: Agreed, sentence clarified. The results from the Co. Tyrone catchment indicate that significant soil P source status reductions in the index 4 high risk category were achievable within the five year time frame of this study and are indicative of a convergence to optimum soil P status (index 2: 16-25 mg P L⁻¹) in this catchment.

31. P10977 17-20: This sentence is not really clear; what was more indicative? Are you referring back to the reductions made? Please rephrase sentence. Response: Agreed, sentence clarified. “This fractured response is shown by assessment of the influence of changes in the sub-catchments on diffuse nutrient transfer which on the one hand did not reflect the reductions made in soil P status of the Co. Tyrone sub-catchment but, on the other hand, were more indicative of the soil P increases seen in Co. Monaghan.”

32. P10977 17-24: You mention the possibility that natural diffuse sources of P could have offset the effect of soil management changes. Did you see any indications of an increase in for instance extreme high events that could facilitate bank erosion? I suppose the contribution from bank erosion should have increased in this period, if it were to offset the changes in management? Please elaborate on this. Response: This is speculative discussion based on balancing what was observed with other experiences from the literature. No amendment made.

33. P. 10977, line 28: “improvement” should be plural. Response: Agreed – amended.

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“Despite the mitigation measures introduced to the catchments, the Q80–Q90 and Q90–Q95 results in Cos. Tyrone and Monaghan suggest that few improvements to point source inputs to the streams have taken place.”

34. P. 10978, line 17: delete “the” after “TP”. Response: Agreed – amended. “For example, TP loads from the grassland catchments of this study were 0.89 to 2.12 kg P ha^{–1} and 1.50 to 3.98 kg P ha^{–1}, in Co. Tyrone and Co. Monaghan, respectively.”

35. Fig. 6. The figure does not show percentiles, it is a flow duration curve, please correct that in the title. Response: Agreed – amended. See point 26, above.

36. Table 5. If you want to show the statistical percentiles, you should correct (i.e. the last column shows the 90-95th percentiles), otherwise delete “percentile” and explain in the text what the percentages represent. Could you please include the unit (mg P L^{–1}, I assume). Response: Agreed – amended.

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