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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Spatio-temporal heterogeneity of riparian soil morphology in a restored floodplain" *by* B. Fournier et al.

Anonymous Referee #1

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Summary: This was an interesting study looking at the effects of a river widening restoration project on floodplain soil morphological properties along lateral gradients. The authors utilized ecosystem metrics such as diversity, richness, evenness, dynamism and typicality to describe floodplain soil properties within paired restored and non-restored river reaches. The use of traditional ecological metrics in soils research was a novel approach and showed good correlation with other studies of the same river system. The important findings of this research were that river widening resulted in increased fluvial dynamics within the floodplain and the creation of two distinct lateral vegetation zones within the restored floodplain. Flooding within the restored riparian areas led to sparsely vegetated zones closer to the river and more stable alluvial forests further from the river. These changes also resulted in more complex soil morphologies

and greater soil diversity within the restored floodplain. Overall the manuscript is well written and relatively straightforward, although I identified a couple major points that should be addressed before publication.

The first major point is that the study site background section is relatively sparse. Studies in floodplains require extensive knowledge and background not only of the river system, but also the larger drainage basin. The current study site description is fairly vague and needs to be improved to give readers a detailed description of the Thur River, its riparian area, and surrounding watershed. I would strongly encourage the authors to create a study map showing in detail the Thur River restoration and control sites, as well as the greater Thur drainage area. More information within the study site description regarding the river basin size, geology, slope, land use, and restoration project is needed to properly put the research in context for readers.

The second major point is the gap between the description of the metrics (richness, diversity and evenness specifically) used to analyze the floodplain soil morphology and those reported in the results. Currently the methods section lists richness (N0), Shannon and Simpson diversity (N1, N2) and evenness (N1/N0, N2/N0) as the major criteria used to analyze soils on the floodplain. However, the results tables have undefined variables listed as N0, N1, N2, E1, E2, J. Since these measures are central to the paper, they need to be thoroughly defined in the methods section and referred to consistently throughout the paper.

Specific comments:

P4339L6-7: I suggest minor rewording of this sentence, "the number of river restoration projects aiming to increase ecosystem goods and services such flood abatement, biodiversity and water quality improvement is increasing worldwide."

P4339L16: I suggest replacing the word "precious" with something like "sought-after"

P4340L3: I would reword this sentence more towards the fact that soils are not as

quick to change as vegetation and hydrology, making them easier to monitor over short time intervals. I would not say alluvial soils are simpler to monitor, because from a purely physical sampling perspective soils are much more difficult to sample than aboveground vegetation.

P4341L1-26 Study site section: There needs to be more background on the Thur River here. Specific questions I had about this system were: What is the size of the drainage basin (km2) above the river restoration in this study, what is the average slope of the basin, what is the current and historical land cover in the basin, is seasonal snowmelt a major driver of flooding in this system? Also was the river restoration done with heavy equipment and did this in any way impact the floodplain soils of the restoration site?

I believe a detailed map of the study site (including the open habitat-forest transects and reference pasture transects) would help putting this site into context. Perhaps two representative elevation profiles (above mean sea level or relative elevation) would be useful to show the topographical changes from the river across the floodplain at the two sites (restored vs. reference). Figures 1 and 2 from "Noe, G.B., C.R. Hupp, and N.R. Rybicki. 2013. Hydrogeomorphology influences soil nitrogen and phosphorus mineralization in floodplain wetlands. Ecosystems 16: 75–94" are good examples of these types of figures.

P4343L3-4: I would suggest spelling out World Reference Base (WRB) and Référentiel Pédologique FranÒńais (AFES) at first mention here.

P4343L10-20: The soil diversity section should correspond directly to the results tables. Currently the variables listed in this section do not exactly match those in Tables 3 and 5 (it is unclear what E1, E2, and J are). I would also suggest a brief explanation of the variables, such as greater values of Shannon diversity (N1) correspond to greater soil diversity, etc.

P4344L8-10: What is the precision of the topographical surveys used to calculate elevation deltas here? How were the surveys derived (in the field using laser level, GPS,

etc.)?

P4344L22: I would remove the word "mainly" before characterized.

P4346L12: What statistical program was used for the Kruskal-Wallis tests? Maybe add this in the methods section.

P4349L1: Is (Fraxinion) supposed to be Fraxinus (ash) here?

P4349L3: Species Helvetica should be lower case (helvetica)

P4350L1-4: I suggest minor rewording of the first sentence as "The dynamism and typicality of soil morphology, as described here, can thus allow for prediction of potential major changes in vegetation and other organisms responding either directly to changes in soil type or to changes in vegetation resulting from a river restoration project."

P4350L4-7: This is an important discussion point brought up by the authors; that floodplain soil-landscape formation can take considerable time. If more immediate results are desired additional floodplain restoration may be needed, such as the creation of artificial landscapes where hydromorphic wetland soils could persist. I would suggest adding a couple citations that speak to this point or any studies where restoring floodplain wetlands has been successful.

P4352L10: Baize and Girard 2008 is included in the references but not cited in the text.

P4355L4: Orr et al. 2007 is duplicated here within the references.

Tables 3 and 5 need to have expanded explanation, currently the diversity and richness variables are poorly defined. The tables should stand alone from the text, an expanded caption or footnotes regarding the measures would greatly improve these tables. In addition, the nomenclature used in the table is not entirely in line with the text. In the methods section (2.4.1) richness (N0) and Shannon/Simpson diversity (N1, N2) are defined. Evenness measures are indicated as N1/N0 and N2/N0. Yet the tables have E1, E2, J listed as the variables. The tables should match the nomenclature given in

the methods section.

Fig. 2.: for these elevation delta data, are these gross rates of change? There is both erosion and deposition for the same time period at the same position along the lateral gradient, is this a function of the fact that some of the study transects displayed erosion and others deposition? Would a grand mean net measurement be more useful (sedimentation minus erosion for each transect and position along the lateral gradient) for each distance from the river? It is currently difficult to discern which process is dominant before and after restoration.

Fig. 5. Needs axis titles with units of measure.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 10, 4337, 2013.