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Can terrestrial diversity be predicted from soil morphology?

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Restoration ecology is a young discipline and, as a consequence, many concepts and methods are not yet mature. A good example of this is the case of floodplains which have been intensively embanked, dammed or otherwise engineered in industrialized countries, but are now increasingly being restored, often at high cost. There is however much confusion over the goals of floodplain restoration projects and the methods, criteria, and indicators to assess their success.

Nature practitioners are interested in knowing how many and which variables are needed for an efficient monitoring and/or assessment. Although many restoration success assessment methods have been developed to meet this need, most indicators currently used are complicated and expensive or provide only spatially or temporally limited information on these complex systems. Perhaps as a result, no standard method has yet been defined and post-restoration monitoring is not systematically done.

Optimizing indicators would help improve the credibility of restoration projects and would thus help to convince stakeholders and managers to support monitoring programs. As a result, defining the predictive power of restoration success indicators, as well as selecting the most pertinent variables among the ones currently used is of major importance for a sustainable and adaptive management of our river ecosystems.

Soil characteristics determine key functions (e.g. decomposition) and ecosystem structure (e.g. vegetation) in terrestrial ecosystems. They therefore have a high potential information value that is, however, generally not considered in floodplain restoration assessment. In order to explore this potential, we recently developed a new synthetic indicator based on soil morphology for the evaluation of river restoration success. Following Hutchinson's ecological niche concept, we hypothesised that terrestrial biodiversity can be predicted based on soil characteristics, but that these characteristics do not perform equivalently for all taxonomic group.

In this study, we explored the potential of soil morphology as a proxy for biodiversity. We used results of a previous research seeking at developing soil morphology based indicators for floodplain restoration assessment, as well as surveys of vegetation, bacteria, earthworms, and terrestrial arthropods from the same site (River Thur, CCES project RECORD: http://www.swiss-experiment.ch/index.php/Record:Home) to analyse the relationships among soil morphology and biodiversity variables and assess the efficiency of this river widening. Furthermore, we defined the best performing predictive soil variables for each taxa.

Soil morphology indicators performed well in predicting terrestrial arthropod richness supporting the idea that this relatively simple indicator may represent a useful tool for the rapid assessment of floodplain restoration success. However, the indicators performed variously concerning other taxa highlighting the methods limitation and giving clues for future improvements. We conclude by discussing the potential of soil morphology in conservation biology and its possible applications for nature practitioners.