

Let's be honest: addressing key uncertainties in stream restoration design and decision-making

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Abstract. Despite huge investments over the last quarter century in the US, it is widely recognized that the ubiquitous practice of stream restoration has produced few documented cases of long-term ecological benefits, especially at the watershed scale. This dubious track record results from several factors including inadequate monitoring and feedback, an emphasis on small-scale static projects that are not outgrowths of a watershed approach, disconnects between research and practice, and insufficient tools and understanding to address the formidable complexity and uncertainty that are commonly encountered. This presentation will primarily focus on the latter issue and suggest pragmatic approaches that may assist practitioners in addressing some of the key challenges and uncertainties that currently impede project effectiveness, as well as maturation of the practice of stream restoration. These challenges include estimating sediment supply and transport capacity over time, the integration of analog, analytical, and self-design approaches in design, and decision analysis at the watershed scale. In particular, tradeoffs among aquatic habitat and other performance goals, passive vs. structural interventions, channel-vegetation coevolution, and costs will be discussed in the context of risk analysis. Project case studies will be used to describe a spectrum of passive to intensive structural interventions, and how these various projects addressed (or could have addressed) uncertainty in design and decision-making. For example, a large ongoing project on the upper Arkansas River near Leadville, Colorado will be used to illustrate how a project design can evolve as uncertainty in future flows, sediment continuity analyses, and other factors are openly addressed. Given the current state of our knowledge, and in particular the low success rates of structure-based restoration projects, the practice of stream restoration can in most cases significantly improve its ecological effectiveness by prioritizing more passive and strategic approaches that emphasize stressor removal, self-organization, and careful targeting in the watershed. Decisions on whether to adopt a relatively intensive (perhaps invasive) vs. passive restoration approach, and whether to attempt restoration at all, should be explicitly based on a candid assessment of the key aspects of uncertainty common to the vast majority of stream restoration proposals.