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Using the UK as a Case Study to Assess the Current State of Large Woody Debris Restoration as a Tool for Improving the Ecological Status of Natural Watercourses Globally

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Abstract : Natural watercourses provide a range of vital ecosystem services, notably freshwater provision. They also offer highly heterogeneous habitat which supports an extreme diversity of aquatic life. Exploitation of rivers, changing land use and flood prevention measures have led to habitat degradation and subsequent biodiversity loss; indeed, freshwater species currently face a disproportionate rate of extinction compared to their terrestrial and marine counterparts. Large woody debris (LWD) encompasses the trees, large branches and logs which fall into watercourses, and is responsible for important habitat characteristics. Historically, natural LWD has been removed from streams under the assumption that it is not aesthetically pleasing and is thus ecologically unfavourable, despite extensive evidence contradicting this. Restoration efforts aim to replace lost LWD in order to reinstate habitat heterogeneity. This paper aims to assess the current state of such restoration schemes for improving fluvial ecological health in the UK. A detailed review of the scientific literature was conducted alongside a meta-analysis of 25 UK-based projects involving LWD restoration. Projects were chosen for which sufficient information was attainable for analysis, covering a broad range of budgets and scales. The most effective strategies for river restoration encompass ecological success, stakeholder engagement and scientific advancement, however few projects surveyed showed sensitivity to all three; for example, only 32% of projects stated biological aims. Focus tended to be on stakeholder engagement and public approval, since this is often a key funding driver. Consequently, there is a tendency to focus on the aesthetic outcomes of a project, however physical habitat restoration does not necessarily lead to direct biodiversity increases. This highlights the significance of rivers as highly heterogeneous environments with multiple interlinked processes, and emphasises a need for a stronger scientific presence in project planning. Poor scientific rigour means monitoring is often lacking, with varying, if any, definitions of success which are rarely pre-determined. A tendency to overlook negative or neutral results was apparent, with unjustified focus often put on qualitative results. The temporal scale of monitoring is typically inadequate to facilitate scientific conclusions, with only 20% of projects surveyed reporting any pre-restoration monitoring. Furthermore, monitoring is often limited to a few variables, with biotic monitoring often fish-focussed. Due to their longer life cycles and dispersal capability, fish are usually poor indicators of environmental change, making it difficult to attribute any changes in ecological health to restoration efforts. Although the potential impact of LWD restoration may be positive, this method of restoration could simply be making short-term, small-scale improvements; without addressing the underlying symptoms of degradation, for example water quality, the issue cannot be fully resolved. Promotion of standardised monitoring for LWD projects could help establish a deeper understanding of the ecology surrounding the practice, supporting movement towards adaptive management in which scientific evidence feeds back to practitioners, enabling the design of more efficient projects with greater ecological success. By highlighting LWD, this study hopes to address the difficulties faced within river management, and emphasise the need for a more holistic international and inter-institutional approach to tackling problems associated with degradation.

Keywords : biological monitoring, ecological health, large woody debris, river management, river restoration
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