A Short Note on River Restoration: terminology

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Abstract

The present note has been prepared as a complementary material for the course 'River Restoration in Europe' at the Faculty of Engineering (LTH), Lund University, Sweden. It aims to explain the terminology of river restoration and other related concepts by a brief review of literature sources. At the end, additional recommended reading materials are listed.

Introduction

It has been about a century that the river restoration has become a national and even international effort to improve the water quality and also the integrity of aquatic ecosystems. Significant increase in resource allocation for river restoration projects on the one hand and the rise of interest among a wide range of engineers and researchers in this field on the other hand, are alluding to the fact that a fundamental understanding of river restoration paradigm is a necessity. River restoration, as a burgeoning interdisciplinary field of study, has been defined in a number of ways, each of which emphasizing a particular facet of restoration. Therefore, there is no wonder that we are facing a basic issue that researchers/engineers from diverse disciplines and locations have built up different perceptions in this realm. This difference of perception could be a cause of disagreement, impractical solutions, inefficient approaches or measures, etc., even so the root cause could be as simple as a vocabulary difference.

A variety of experts are taking part in restoration projects, namely civil and construction engineers, environmental engineers, hydrologists, ecologists, biologists and even economists. In light of the above, a common ground of definition (terminology) is essential to facilitate their technical communication. This enables them to set realistic and proper goals, produce and introduce viable measures, and avoid conflicts and inefficiency.

River Restoration

Numerous terms referring to interventions and/or improving measurements within the riverine environment have been used by river managers. According to different literature sources, the term 'river restoration' has been defined in different ways by different authors (see Table 1).

Table 1. A few examples of 'river restoration' definitions.

Authors	Definition
Cairns Jr (1991)	"The complete structural and functional return to a pre-disturbance state."
Gore (1985)	"In essence, river restoration is the process of recovery enhancement. Recovery enhancement enables river or stream ecosystem to stabilize (some sort of trophic balance) at a much faster rate than through the natural physical and biological processes of habitat development and colonization. Recovery enhancement should establish a return to an ecosystem which closely resembles unstressed surrounding areas."
Osborne et al. (1993)	"Restoration programs should aim to create a system with a stable channel, or a channel in dynamic equilibrium that supports a self-sustaining and functionally diverse community assemblage."
Herricks and Osborne (1985)	"Implicit in the concept of water quality restoration is some knowledge of the undisturbed or natural state of the stream system. Restoration of water quality can be defined as returning the concentration of substances to values typical of undisturbed conditions."

It should be noted that no universal definition has been established yet. However, Cairns Jr's (1991) definition is one of the most widely-used definitions, although it is evident that such level of restoration is idealistic and rarely practiced.

In addition to 'river restoration', other related terms have also been used to address and define different types of river restoration (or management). Four of the important terms, namely full restoration, rehabilitation, enhancement and creation, are described in Table 2.

Table 2. Definition of different types of restoration.

Term	Definition	Management approach
Full restoration	"The complete structural and functional return to a pre-disturbance state."	Direct intervention, natural recovery, or enhanced recovery
Rehabilitation	"Partial return to a pre-disturbance structure or function"	Direct intervention or enhanced recovery
Enhancement	"Any improvement in environmental quality"	Mainly direct intervention
Creation	"Development of a resource that did not previously exist at the site. Includes the term "naturalization" which determines morphological and ecological configuration with contemporary magnitudes and rates of fluvial processes."	Direct intervention

It could be understood from Table 2 that all except 'full restoration', involve direct (anthropogenic) intervention in terms of management approach. It is important to note that full restoration requires natural recovery. In other words, in case of full restoration the nature takes care of restoration in its own way without any interventions; there are specific modifications that could be done merely by nature and time.

References

Cairns Jr, J. (1991). The status of the theoretical and applied science of restoration ecology. *Environmental Professional, 13*(3), 186-194.

Gore, J. A. (Ed.). (1985). *The Restoration of rivers and streams: theories and experience*: Butterworth Publishers.

Herricks, E. E., & Osborne, L. L. (1985). Water quality restoration and protection in streams and rivers. In J. Gore (Ed.), *The Restoration of rivers and streams: theories and experience*: Butterworth Publishers.

Osborne, L. L., Bayley, P. B., Higler, L. W. G., Statzner, B., Triska, F., & Iversen, T. (1993). Restoration of lowland streams: an introduction. *Freshwater Biology, 29*(2), 187-194.

Recommended Further Readings

Brookes, A., & Shields, F.D. (1996). Perspectives on river channel restoration. In A. Brookes & F.D. Shields (Eds.), *River channel restoration: guiding principles for sustainable projects* (pp. 458): Wiley.

Hansson, L.-A., Brönmark, C., Anders Nilsson, P., & Åbjörnsson, K. (2005). Conflicting demands on wetland ecosystem services: nutrient retention, biodiversity or both? *Freshwater Biology, 50*(4), 705-714.

Kondolf, G.M. (1998). Lessons learned from river restoration projects in California. *Aquatic Conservation: Marine and Freshwater Ecosystems, 8*(1), 39-52. Available at http://www.elkhornsloughctp.org/uploads/files/1116286604Kondolf%201998.pdf.

Palmer, M. A., Bernhardt, E. S., Allan, J. D., Lake, P. S., Alexander, G., Brooks, S., . . . Sudduth, E. (2005). Standards for ecologically successful river restoration. *Journal of applied ecology, 42*(2), 208-217. doi: 10.1111/j.1365-2664.2005.01004.x Available at http://onlinelibrary.wiley.com/doi/10.1111/j.1365-2664.2005.01004.x/pdf

Petersen, R.C., Petersen, L.B.M., & Lacoursiere, J. (1992). A building-block model for stream restoration. In P. J. Boon, P. Calow & G. E. Petts (Eds.), River conservation and management (Vol. 293, pp. 293-309). Chichester, England, UK: John Wiley & Sons Ltd. Available at https://www.academia.edu/4996112/A_Building-block_Model_for_Stream_Restoration.

Polster, D.F., Horel, G.M., Pike, R.G., Miles, M., Kimmins, J.P., Uunila, L.S., Scott, D.F., Hartman, G.F., Wong, R.H. (2010). Stream, Riparian, and Watershed Restoration. In R. Pike, T. Redding, R. Moore, R. Winkler & K. Bladon (Eds.), *Compendium of forest hydrology and geomorphology in British Columbia* (pp. 882). Victoria, B.C.: Ministry of Forests and Range Forest Science Program. Available at http://www.for.gov.bc.ca/hfd/pubs/Docs/Lmh/Lmh66.htm.

Wheaton, J. M. (2005). *Review of River Restoration Motives and Objectives*. Unpublished Review. Southampton, UK. Available at http://www.geog.soton.ac.uk/users/wheatonj/downloads/motivesandobjectives.pdf.

Wohl, E., Angermeier, P. L., Bledsoe, B., Kondolf, G. M., MacDonnell, L., Merritt, D. M., Palmer, M. A., Poff, N. L., Tarboton, D. (2005). River restoration. *Water resources research, 41*(10), W10301. doi: 10.1029/2005WR003985. Available at http://www.wou.edu/las/physci/taylor/g473/refs/wohl_etal_2005_restoration.pdf.