A Method for Applying Fluvial Geomorphology in support of Catchment-Scale River Restoration Planning


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Background

In the European context, an important driver for the conservation and restoration of river habitats has been the advent of the Habitats Directive (EEC 92/43) and Water Framework Directive (EU 2000). What the former specifically relates to the conservation of designated wildlife and habitats within a network of protected sites, the latter is concerned with the integration of water management on the common vision of attaining Good Ecological Status of watercourses within a set timetable (Furse & Loggen 2002). However, significant barriers to achieving conservation objectives or restoration of damaged aquatic ecosystems remain, notably quantifying favourable conditions for particular habitats or species, developing methods and protocols for collecting information relevant to monitoring the “condition” of in-stream habitats, and the development of methods for integrating physical habitat and biological data. This poster details the development and application of a geomorphological audit approach to the assessment of the condition of physical habitat within river channels, with the aim of identifying a catchment-wide strategy for rehabilitation.

Methods

The methodological approach to developing the vision and strategy for restoration is based on:

1. Developing an understanding of chalk stream geomorphological processes based on a review of extant literature coupled with specific analysis of the River Nar.
2. Developing field reconnaissance and baseline assessment of in-stream conditions of the River Nar, an important chalk stream in the southern England, extent of damage due to land use and water management practices. The river was identified as being in poor ecological condition due to the impact of land use and management, including artificial culverts, riparian enclosures and the increased flow rates above the floodplain.
3. In this study, the river channel was divided into geomorphologically defined reaches (hence why reach-length differs). The characteristics of the physical habitat and channel morphology of the River Nar in its current condition.
4. Developing a method for classifying river reaches which integrates the data generated through the fluvial audit.
5. Developing a method for assessing the condition of river reaches in the River Nar in order to support on the options for restoration.
6. To consider the sediment transport issues associated with the degradation of the river SSSI and to suggest options for mitigation.

Study Site

The River Nar drainage the western margins of the Fen Basin and rises on permeable chalk over lain by glacial sands, gravels and boulder clay (Fig 2). Soils are mixed with erodible sandy loams adjacent to the dry valleys that extend the river network. The only mobile elements of the sediment system are sands, silts and clay. Thus the coarse gravel bed is a relic feature of past processes. Fine sediment accumulation in the system is highly sensitive to loads since flushing capability is limited by the low transport rates driven by low gradient and discharge regime. The Fen basin marks an important transition with a gravel transition to sands and silts. A 900 year history of river modification for agricultural drainage and navigation has resulted in extensive alterations to the river morphology and connectivity with the floodplain (Fig 3). Despite this, the River Nar has a designated conservation status as a Special Site of Scientific Interest based on the diversity of aquatic plants.

Discussion

Options for restoration are given in Figure 5. These are based on an assessment of the main contributory factors to the naturalness scores and modification scores. Each reach was also checked against the photographs and map-based information on the GIS. Figure 6 shows the catchment-scale classification of management options for the river Nar. These are reach-based solutions that require additional contextualisation. We used the known catchment-scale problems to set a series of additional constraints on the restoration process ensuring that prioritising of the restoration options should be guided by catchment scale requirements:

1. Establish a programme for treating the sediment ingress problems prior to any physical habitat restoration/rehabilitation or enhancements.
2. Set in place a condition monitoring plan for all semi-natural/natural and recovering reaches.
3. Prioritize the restoration on the basis of linking existing natural/natural reaches first.
4. Seek to improve those reaches closest to semi-natural/natural conditions.

The management options do not take into account landscape/cultural aspects, neither do they account for any particular set of biota or stakeholder interests.

Conclusion

Fluvial Audit coupled with MCA provides a science and evidence-based framework for decision making in river restoration planning from a catchment to meso-habitat scale. It also provides an interface for incorporating wider and user-interests through engagement in the scoping and weighting system used to develop models of naturalness. This might in the future include information from other scientific disciplines; the results of new research; and the views of stakeholders. Linking this analysis to a GIS permits the modifications to the naturalness or modification models, to be visualised in a geographic space that is meaningful to most participants. Thus an important feature of the methodology is to recognise that it is adaptive; the results and plans are expected to change over time.

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