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CHANNEL ADJUSTMENTS AND IMPLICATIONS FOR RIVER MANAGEMENT AND RESTORATION

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Most Italian rivers have experienced widespread channel adjustments over the last 100 years, mainly in response to a range of human activities. The aim of this paper is to show how knowledge of channel adjustment and reconstruction of evolutionary trajectory are or can be used in river management and restoration. The first part of the paper deals with channel adjustments and summarizes the results of recent studies carried out on twelve rivers in northern and central Italy. The second part illustrates three examples of application.

The selected rivers have undergone almost the same processes in terms of temporal trends. Initially, river channels underwent a long phase of narrowing (up to 80%) and incision (up to 8-10 m), which started at the end of the 19th century and was very intense from the 1950s to the 1980s. Then, over the last 15-20 years, channel widening and sedimentation, or bed-level stabilization, have become the dominant processes in most of the rivers, though channel narrowing is still ongoing in some reaches. Channel adjustments were mainly driven by human actions, but the role of large floods was also notable in some cases. Different human interventions have been identified as the causes of channel adjustments (sediment mining, channelization, dams, reforestation and torrent control works). Such interventions have caused a dramatic alteration of the sediment regime, whereas effects on channel-forming discharges have seldom been observed.

The first example of application concerns a new methodology designed for assessing the hydromorphological condition of Italian rivers and for monitoring their condition through time. This methodology is required in the context of the Water Framework Directive (2000/60/EC) which aims to assess the ecological status of rivers not only using biological and chemical elements, but also hydromorphological elements. The second example illustrates the potential of channel recovery in five gravel-bed rivers of north-eastern Italy. After defining four categories of channel taking into account recent evolution, it was analysed how different sediment management strategies could affect future channel dynamics. We concluded that even though both reach and basin-scale interventions may be carried out, it is likely that channels will not recover to the morphology they exhibited in the first half of the 20th century, since sediment yield and connectivity will remain less than during the 19th century and the first half of the 20th century. The last example deals with solutions for promoting future sustainable management of sediment and channel processes in the Magra River catchment. Knowledge of channel evolution and its causes was used as a basis for defining channel and sediment management strategies, coupled with quantification of bedload transport and bed sediment budget, and the identification of areas most suitable for potential sediment recharge.

KEY WORDS: Hydromorphology, Channel recovery, Italian rivers.

INTRODUCTION

River management and restoration are complex activities which have to take into account different aspects, such as human safety from floods, economic interests, existing and potential ecological values and benefits. In this context it is increasingly recognized that a range of approaches (e.g. hydrology, ecology, geomorphology) have to be used if sound management strategies are desired. The role of geomorphology has been stressed by several studies (e.g. Downs & Gregory, 2004; Brierley & Fryirs, 2005; Habersack & Piegay, 2008) but also recognized by recent legislation (European Commission, 2000). Long-term channel evolution and sediment dynamics at basin and reach scale are key geomorphological issues for river management and restoration. Reconstruction of channel changes over the last 100-200 years allows to relate the present riv-

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