

## **ACCELERATED RIVER EROSION DUE TO HUMAN ACTIVITY AT THE APENNINE MARGIN (NORTHERN ITALY)**

MARCHETTI M. and SOLDATI M.

Dipartimento di Scienze della Terra, Università degli Studi di Modena e Reggio Emilia,  
Largo S. Eufemia 19, 41100 Modena, Italy – Tel. +39 059 2055811, Fax +39 059 2055887,  
e-mail: [marchet@unimore.it](mailto:marchet@unimore.it) - [soldati@unimore.it](mailto:soldati@unimore.it)

River channel changes due to accelerated erosion, as an effect of human activity on the fluvial system, have been particularly severe since the decade 1960-70 at the Apennine margin of the Po Plain (northern Italy). The rivers have, in fact, been exposed to rapid socio-economic transformation and industrial growth in this piedmont area after the Second World War. Following this rapid and intense development, the density of the population dramatically increased in the middle and lower sectors of the river basins (at present it exceeds 200 inhabitants km<sup>-2</sup> in the Po Plain), whereas the mountain areas have become more and more depopulated. In general, the observed reduction in sediment transport coincided with an attenuation of peak flows. This can be mainly attributed to reforestation, stabilisation of lower order channels in the catchments and construction of river works, in particular embankments, dams or channelisation. The latest human intervention, which in the recent past has become the main factor of river degradation, is gravel extraction from riverbeds, which is one the main causes of the accelerated erosion occurred along the riverbeds of the southern tributaries of the River Po crossing the Modena region. In this sector of the Po Valley, owing to the scarceness of gravel and sand deposits on the alluvial plain, quarrying activities have been concentrated directly in riverbeds; these materials are, in fact, indispensable for the building industry. This has caused remarkable geomorphological effects on the river system that can be summarized as follows: i) partial or complete erosion of present and past alluvial deposits causing local outcropping of the clayey bedrock; ii) confining and deepening of the riverbed causing increased stream velocity; iii) inversion of groundwater flow, which thus resulted from acquifers to the rivers; iv) reduction of sediment supply to the coastal system. Gravel extraction has also caused induced risks for human activity. Many problems arose due to destabilisation of engineering works on rivers, such as bridges and dams. During the 1960s and the 1970s, in the district of Modena, the rivers Secchia and Panaro degraded along their upper plain stretches, corresponding to about 12 and 6 m of downcutting, respectively. Along these rivers, a few bridges collapsed or were severely damaged. Therefore, in order to preserve bridges, it was necessary to build barrage works. Lately, a new awareness has been growing in both the population and public officers. In-channel quarrying is generally forbidden and many re-naturalisation measures have been implemented or planned.

Keywords: fluvial erosion, quarrying, impact, risk, northern Italy