RECENT MORPHOLOGICAL CHANGES OF THE RIVER PANARO (NORTHERN ITALY)

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ABSTRACT: Castaldini D. & Ghinoi A., Recent morphological changes of the River Panaro (Northern Italy) (IT ISSN 0394-3356, 2008).
This paper describes the morphological changes of the River Panaro from the 19th century to date and provides the relationships between human activity and stream geometry. The studies were carried out using historical documents and maps, aerial and satellite imagery taken on various dates, digital treatment of maps and orthophotographs and field surveys.

The River Panaro has a catchment basin of 1,784 km² and collects waters from the central section of the Northern Apennines. It starts from the confluence of the Scoltenna and Leo torrents and flows down through Modena Apennines for some 63 km. Then it makes its way across the Po Plain for 85 km until it joins the River Po. In the Po Plain it flows across two distinct sectors with different morphological characteristics: in the upper sector the river runs deep in the alluvial plain, whereas in the mid-lower part it is elevated above the level of the plain, contained within artificial embankments.

In the Panaro valley, from the 1930s to the 1950s, the river showed a braided pattern which occupied almost the entire flat valley floor. Important changes occurred later, due to the downcutting and narrowing of the active channel, which have continued until the present day.

In the upper part of the plain, the river occupied a large depression with a braided riverbed at the beginning of the 19th century. In the following periods there was an increase of human interventions along the river (construction of embankments, walls and groynes), in order to reclaim surrounding areas from flooding and turn highwater beds into farming land. This led to narrowing in several stretches of the riverbed, although it still maintained a braided pattern until the 1930s. Subsequently, after the 1950s, the braided pattern became canalised and deepened and the shape of the longitudinal profile changed from a hyperbola-type curve to a step-type one.

The channel changes in the Apennines and in the upper part of the plain were mainly due to gravel excavation along the riverbed. Quarrying activities stopped after a law was passed in the early 1980s and, at the same time, fluvial barrages were constructed. On the whole, these hydraulic works reduced the bed load, increasing water erosion power downstream. As a result, the deepening process has continued and a new terrace level has formed in the past 30 years.

Channel adjustments have led to the change from a braided channel pattern to a transitional one.

In the mid-lower part of the plain, the river length has been reduced by 10-11 km (which corresponds to about 13% of its length in this plain sector) by artificial meander cut-offs carried out since the 19th century to reduce flood hazard. In this way, along long stretches of its course, the River Panaro has assumed the aspect of an artificial watercourse. Since the cut-offs did not adequately reduce flood hazard, “flow regulation systems” were constructed in the area east of Modena.

It can therefore be stated that the morphology and evolution trend of the River Panaro have been conditioned by direct and indirect human activities over the past two centuries, especially after the 1950s, and that its evolution is similar to what has been recorded in other Italian rivers.