

Historical Maps Potential on the Assessment of the Hydromorphological Changes in Large Rivers: Towards Sustainable Rivers Management under Altered Flows

Alban Kuriqi (1), M. Rosário Fernandes (2), Artur Santos (2), and M. Teresa Ferreira (2)

(1) Civil Engineering Research and Innovation for Sustainability (CERIS), Instituto Superior Técnico, Universidade de Lisboa, Lisbon 1049-001, Portugal, e-mail: alban.kuriqi@tecnico.ulisboa.pt, (2) Centro de Estudos Florestais (CEF), Instituto Superior de Agronomia, Universidade de Lisboa, Tapada da Ajuda, 1349-017 Lisboa, Portugal

Abstract

Hydromorphological patterns changes in large rivers, result from a long history of human interventions. In this study, we evaluate the causes and effects of hydromorphological alterations in the Iberian Minho River using a planform change analysis. We performed a temporal comparison using historical maps (nineteen century) and contemporaneous maps. The studied river was divided in 2.5 km long river stretches in a total of 25 sampling units. The historical maps were initially georeferenced for the WGS84 coordinate system. We used Geographic Information System (GIS) to extract the hydromorphological features and to store and organised the spatial data. The hydromorphological features (sinuosity index, braiding intensity, river corridor and active channel width, lotic and lentic habitats) were mapped by visual interpretation of the historical and the contemporaneous maps on a scale 1:2500 by applying the same methodology. Also, we analysed certain Indicators of Hydrological Alteration (IHA) based on pre- and post-dam daily streamflow data obtained from the Spanish Water Information System (SIA). The results revealed a significant reduction in the active channel width and all sinuosity indexes representing an overall degradation of river conditions. We also noticed a drastic diminution in the number and total area of lentic habitats causing fish habitat shifts. Changes were less evident in upstream sampling units due to diverse Land Use/Land Cover (LULC) changes combine with some geological constraints. These responses were consistent with reductions in mean annual discharge, flood disturbance decrease and minimum flow increase during the summer season. This work allows to understand the evolutionary trajectory of large fluvial system over more than 100 years and to implement concrete measures for sustainable river management.

Keywords: historical maps, large rivers, flow alteration, sinuosity index, lotic and lentic habitats, regulated rivers, river restoration.