Hydrographic Mapping Based on the Concept of Fluvial-Geomorphological Auto-Classification

Authors : Jesús Horacio, Alfredo Ollero, Víctor Bouzas-Blanco, Augusto Pérez-Alberti

Abstract : Rivers have traditionally been classified, assessed and managed in terms of hydrological, chemical and / or biological criteria. Geomorphological classifications had in the past a secondary role, although proposals like River Styles Framework, Catchment Baseline Survey or Stroud Rural Sustainable Drainage Project did incorporate geomorphology for management decision-making. In recent years many studies have been attracted to the geomorphological component. The geomorphological processes and their associated forms determine the structure of a river system. Understanding these processes and forms is a critical component of the sustainable rehabilitation of aquatic ecosystems. The fluvial auto-classification approach suggests that a river is a self-built natural system, with processes and forms designed to effectively preserve their ecological function (hydrologic, sedimentological and biological regime). Fluvial systems are formed by a wide range of elements with multiple non-linear interactions on different spatial and temporal scales. Besides, the fluvial auto-classification concept is built using data from the river itself, so that each classification developed is peculiar to the river studied. The variables used in the classification are specific stream power and mean grain size. A discriminant analysis showed that these variables are the best characterized processes and forms. The statistical technique applied allows to get an individual discriminant equation for each geomorphological type. The geomorphological classification was developed using sites with high naturalness. Each site is a control point of high ecological and geomorphological quality. The changes in the conditions of the control points will be quickly recognizable, and easy to apply a right management measures to recover the geomorphological type. The study focused on Galicia (NW Spain) and the mapping was made analyzing 122 control points (sites) distributed over eight river basins. In sum, this study provides a method for fluvial geomorphological classification that works as an open and flexible tool underlying the fluvial auto-classification concept. The hydrographic mapping is the visual expression of the results, such that each river has a particular map according to its geomorphological characteristics. Each geomorphological type is represented by a particular type of hydraulic geometry (channel width, width-depth ratio, hydraulic radius, etc.). An alteration of this geometry is indicative of a geomorphological disturbance (whether natural or anthropogenic). Hydrographic mapping is also dynamic because its meaning changes if there is a modification in the specific stream power and/or the mean grain size, that is, in the value of their equations. The researcher has to check annually some of the control points. This procedure allows to monitor the geomorphology quality of the rivers and to see if there are any alterations. The maps are useful to researchers and managers, especially for conservation work and river restoration.

Keywords : fluvial auto-classification concept, mapping, geomorphology, river