

A tool to optimize understanding of hydromorphological characteristics for French river management and restauration (CARHYCE)

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Restoring the hydromorphological characteristics of rivers has become a major issue in France since the establishment of the European Water Framework Directive (WFD) in 2000. Hundreds of rehabilitation projects of all sizes have since been developed to improve the ecological quality of French rivers. Despite the fact that the restoration program is already well engaged, practitioners are still asking for tools to support decision-making, in order to better take account of the hydromorphological component in restoring river channels. Such tools are particularly needed to identify river reaches that have to be restored and quantify the physical alteration that effects the ecological functioning of the river. This paper presents the CARHYCE tool that is based on a rich database gathering quantitative descriptions of the characteristics of river reaches (channel geometry, bed grain size, riparian vegetation, stream power, etc.) collected by the French Agency for Water and the Aquatic Environment (ONEMA). It relies on a standardized field protocol applied to more than 1500 river reaches collected throughout the French territory. Analysis and treatment of the data from the CARHYCE database provides three sorts of applications available through a web interface:

- It allows visualization through tables and graphs of the hydromorphological characteristics of any river reach surveyed on the field according to the CARHYCE protocol.
- It provides a rich database with physical parameters of every type of river reach present in France and the corresponding regional hydraulic-geometry relationships.
- It proposes an integrated calculation of the deviation from regional reference models of different parameters of the channel geometry of any reach present in the database. These models have been built from a selection of about 600 reaches considered as poorly impacted by direct human influences. They allow the parameters of the geometry of the channels that do not correspond to the regional norms to be identified.

The reference models and the hydromorphological database provided by the CARHYCE application should not be considered as a rigid framework outlining what the shape of a river should be. Rather, it is an adjustable guide to manage and better understand key parameters controlling hydromorphological pressure on biocenoses. It should be considered as a pre-evaluation tool to assess whether a more complete study should be undertaken and it may provide a good framework for designing restored channels.