

# Applied science for sustainable river management

In the 1960s and 1980s, the river was considered a space to be developed for certain uses, to exploit its resources and to protect itself from risks due to the evolution of the bed, whether from flooding or erosion. The interventions were then defined within the framework of "Development Plans".

Since the 1990s, actions on watercourses have undergone profound changes and diversified. **It is no longer just a question of developing but also of maintaining, managing (sustainably) or restoring so that the watercourse provides a certain number of services.** Diagnostics have become more complex. They are based on the study of the evolutionary trajectory of the bed over several decades. They recognize the importance of the upstream basin, which can experience changes that lead to adjustments of the bed further downstream. It is no longer a question of proposing a layout to meet the problems raised. **Different solutions are generally considered, with the construction of infrastructure (dikes, bank protection, thresholds) being one of them.** The approaches have become integrated, trying to take into account all the issues simultaneously. They are part of a functional or systemic perspective to establish diagnoses whereas previous approaches were much more local (where the problem lies). They were based above all on an analysis of the present state.

Geomorphological issues have become central to river management and a geomorphological study is now often recommended in "global studies" prior to a River Contract or a Water Development and Management Scheme (SAGE) [1]. **How does the river work from a geomorphological point of view? What are the problems associated with this operation? But also, who is responsible for the dysfunctions observed?** Establishing properly what these dysfunctions are and to which they are linked allows us to identify the right solutions. Long focused on symptoms, it is possible, by reconsidering diagnoses more systematically, to focus more on aches and pains. **Geomorphology is thus responsible for maintaining the river body in good health, and in some cases for treating it.**

Geomorphology will shed light on the container (the river bed), assess its robustness or fragility, the associated hazards and risks and their evolution, and the quality of ecological habitats. Geomorphology is used to explain the ecological state of a river. The objective of achieving "good ecological status", as recommended by the WFD (Water Framework Directive) [2], is often based on actions affecting the geomorphology of the bed. This good state is ecological but its achievement is based on **repair actions that are often physical**. Habitat improvement, diversification or reconnection is a matter of physical restoration [3] or "hydromorphological" (e.g., hydrological or geomorphological) [4].

The removal of transversal structures (thresholds or dams) is an eminently geomorphological issue and very sensitive in the current social context. What is the impact of these structures on sediment transit? What will be the adjustment of the bed once they are removed?

On the Rhine downstream of the Kembs dam, it was planned to **restore solid transport in order to diversify aquatic habitats**. The geomorphological approach made it possible to assess the risks associated with this action, the risk of rapid downstream transfer of the bottom load and disruption of navigation, the risk of changing water lines and increasing the frequency of flooding, and the risk of destabilizing the bottom. It also showed that this solution should undoubtedly be combined with a widening of the bed to fully bear fruit in restoring the river's good ecological status.

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## References and notes

**Cover image.** Cemented river bed used as a parking lot, Riera de Sant Vicenç, Cadaquès, Spain. [Source: © H. Piegay]

[1] <http://www.gesteau.fr/presentation/sage>

[2] <http://www.onema.fr/elements-d-hydromorphologie-fluviale>

[3] <http://www.eaurmc.fr/actualites-de-lagence-de-leau/detail-de-lactualite/article/nouveau-guide-sur-la-politique-de-restauration-des-riv>

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