European Commission

Science for Environment Policy

New tools for improved river assessment and monitoring are likely to inform future management strategies

Sustainable river management is increasingly informed by hydromorphological stream assessments — evaluations and classifications of stream conditions which account for both hydrological (the movement, distribution and quantity of water) and geomorphological (the processes and forms deriving from the interactions of water and sediment movement) features. In order to provide a more accurate and comprehensive assessment of river character and dynamics, scientists have developed three novel methods. Together, these tools represent a promising technique for conducting collaborative assessment and monitoring of river conditions in Europe.

The EU Water Framework Directive (WFD)[1] recognises hydromorphology (the physical characteristics of the shape, boundaries and content of a water body) as a fundamental component in the classification and monitoring of a river's ecological status. As such, hydromorphological tools are increasingly fundamental to supporting informed sustainable river management actions in Europe. Although numerous novel assessment methodologies have been proposed since the WFD's implementation in 2000, a recent review identified a need for more comprehensive, process-based hydromorphological tools that consider the character and dynamics of the river with greater accuracy.

To meet this need, scientists working under the EU-funded REFORM project[2] have developed and extended three hydromorphological tools for the synergetic assessment and monitoring of river conditions. These novel tools include:

- **Morphological Quality Index** (MQI), which assesses, classifies and monitors the current morphological state of a river (structural features and processes, e.g. sediment continuity, channel geometry and vegetation, erosion character, bank processes) to evaluate its overall morphological conditions and alterations.
- **Morphological Quality Index for Monitoring** (MQIm), which monitors the tendency of morphological conditions, such as enhancement or deterioration, and so can evaluate changes to morphological quality in the short term.
- **Geomorphic Units Survey and Classification System** (GUS), which characterises, classifies and monitors geomorphic units (areas containing a landform created by erosion or deposition inside or outside the river channel) within a river reach.

These complementary tools have already been successfully applied in a number of cases involving Italian rivers. For example, the MQI has been used to assess the morphological status of the Panaro River, Northern Italy, where intense hydromorphological alteration is occurring as a result of strong physical degradation. The MQI and MQIm have been used in tandem to assess the effects of restoration projects on morphological conditions in the Ahr/Aurino River, in the Eastern Italian Alps, as well as to enable a comparative analysis of the varying morphological outcomes of various flood-mitigation scenarios on the Tagliamento River, which drains from the Eastern Alps into the Adriatic Sea. Finally, the MQI and GUS have been integrated to assess and characterise a reach of the Cecina River, Tuscany, Central Italy.

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1. http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32000L0060

2. REstoring rivers FOR effective catchment Management (REFORM) was supported by the European Union under the Seventh Framework Programme. See: http://www.reformrivers.eu/

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New tools for improved river assessment and monitoring are likely to inform future management strategies *(continued)*

Overall, these tools show significant potential for improving the assessment and monitoring of river conditions across Europe. In terms of specific applications, the MQI can be applied for assessing restoration effects on river hydromorphology[3] and the evaluation of the effects of other management actions and interventions. The MQIm is more methodologically demanding, since it requires more effort to measure the spatial extent or density of artificial elements and their morphological impacts. However, it is also more specific, and so is suitable for monitoring and evaluating the effects of small-scale interventions. The GUS is promising, both as a stand-alone qualitative characterisation tool and for integrated use with the MQI assessment, to conduct comparative analyses of the effects of interventions both before and after the event. As such, these novel tools are likely to produce insights that are highly relevant to current and future river-management strategies and policymaking.

3. See: B. Belletti *et al.* (2017). Assessing Restoration Effects on River Hydromorphology Using the Process-based Morphological Quality Index in Eight European River Reaches. *Environmental Management* (2017).