

New methods and tools to assess the hydromorphology of rivers

A new report produced by the REFORM project (Methods, models and tools to assess the hydromorphology of rivers) provides a framework of procedures and tools through which practitioners can:

- assess river hydromorphological conditions,
- set monitoring activities, and
- support the selection of appropriate and sustainable restoration actions.

The assessment framework presented in this report is a more prescriptive version of the open-ended multiscale hierarchical framework for hydromorphological assessment produced in the earlier stage of REFORM (see relevant article in Newsletter No.2). It provides a more formal set of methods and tools with which to practically assess and monitor hydromorphological conditions.

The overall framework comprises the following **four stages**:

1. **Catchment-wide delineation and spatial characterization** of the river system in its current conditions. This is done according to the multiscale spatial framework (see relevant article in Newsletter No.2).
2. Assessment of **temporal changes and current conditions**. This phase involves reconstructing the history and evolutionary trajectories of morphological changes and assessing river conditions in its present state.
3. Assessment of **scenario-based future trends**. This phase is aimed to identify possible scenarios of hydromorphological modification.
4. Identification of **management actions**. This last phase is aimed to identify possible hydromorphological restoration or management actions.

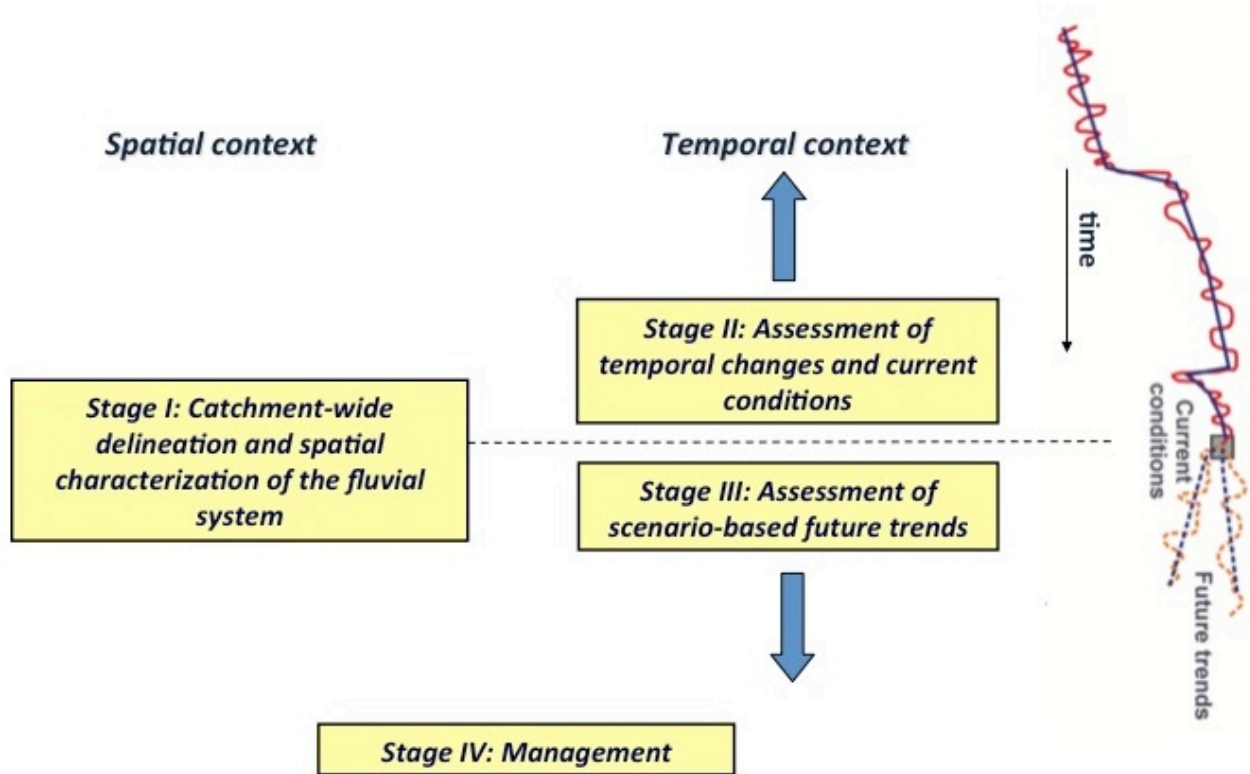


Figure 1: Structure of the overall hydromorphological framework. On the right side, the graph emphasizes that the present state of the river system represents a spot within a long trajectory of evolution that needs to be known to understand current conditions and possible future trends. (source: Rinaldi et al., 2015a)

In addition, our report suggests suitable **methods** for the evaluation of the different components of an overall 'river condition assessment'. The recommendations are based on the integration of three **new tools**, originally developed in Italy and then expanded to other European countries:

- the Morphological Quality Index (MQI),
- the Morphological Quality Index for monitoring (MQIm), and
- the Geomorphic Units survey and classification System (GUS).

The **Morphological Quality Index (MQI)** is strongly based on the consideration of physical processes such as continuity in sediment and wood flux, bank erosion, lateral mobility, and channel adjustments. The spatial scale of application of the MQI is the reach (i.e., a relatively homogeneous portion of the river with a length in the order of some km), which is recognized as the most appropriate and meaningful scale for assessing hydromorphology. The temporal component is explicitly accounted for by considering that a historical analysis of channel adjustments provides insight into the causes and time of alterations and into future geomorphic changes.

The MQI assessment includes a set of 28 indicators assessing longitudinal and lateral continuity, channel pattern, cross-section configuration, bed structure and substrate, and vegetation in the riparian corridor. These characteristics are evaluated by an integration of remote sensing - GIS analysis and field survey. Based on the MQI value (ranging from 0 to 1), five classes are defined to classify morphological quality conditions (from very poor to very good), allowing to investigate the whole gradient of hydromorphological conditions.

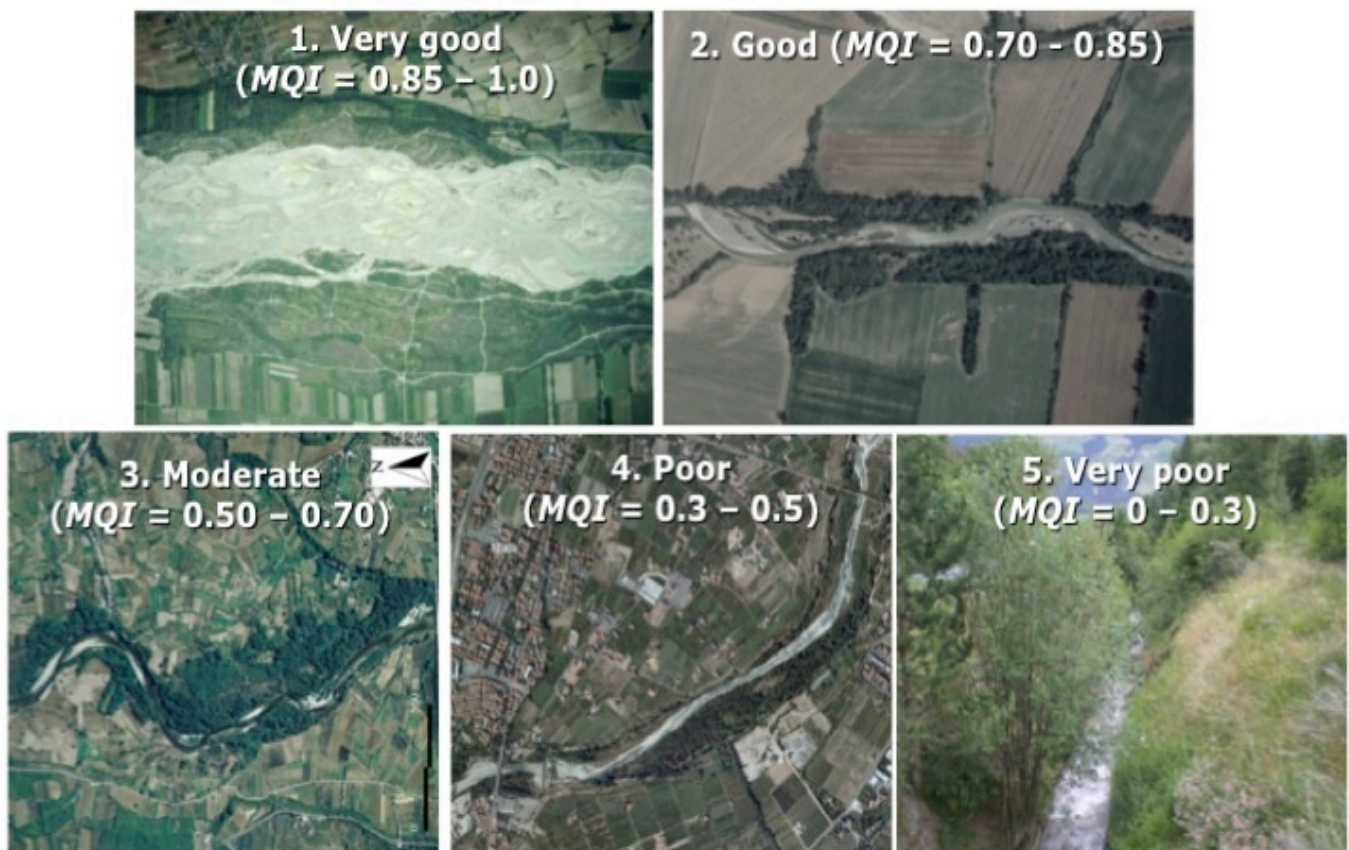


Figure 2: Examples of the five MQI classes. (source: Rinaldi et al., 2015b)

Related to the MQI, a specific tool named **Morphological Quality Index for monitoring (MQIm)** is specifically designed to evaluate the tendency to an enhancement or deterioration of the morphological quality.

Finally, a new specific system for the survey and classification of **geomorphic units (GUS)** in streams and rivers has been developed. The system is suitable for incorporation into the MQI and is also aimed at allowing the establishment of links between hydromorphological conditions at reach scale, characteristic geomorphic units, and related biological conditions.

Key recommendations

- We recommend using two linked process-based approaches to achieve a comprehensive and synergic hydromorphological assessment: (i) the REFORM multiscale hierarchical framework to develop an understanding of river reach hydromorphology; (ii) a more prescriptive approach based on the integration of more specific assessment tools, as outlined in the present newsletter article.
- The multiscale hierarchical framework can be used to underpin the delineation of WFD water body boundaries by a further division in 'reaches' using additional geomorphological criteria such as the classification of river typologies.
- The Morphological Quality Index (MQI) is the recommended method by REFORM for the assessment of river conditions, i.e. for analyzing and interpreting critical problems and causes of alteration. The method should be implemented for the entire gradient of morphological conditions (not only for high status water bodies) for supporting the interpretation of BQEs, and should be supported by a characterization of the assemblage of geomorphic units (GUS) determining the morphology at reach scale.

Further links

D6.2 Final report on methods, models, tools to assess the hydromorphology of rivers

- Part 1 Main report with overall framework for hydromorphological assessment
- Part 2 Thematic annexes on protocols for monitoring indicators and models
- Part 3 Guidebook for the application of the Morphological Quality Index (MQI)
- Part 4 Geomorphic Units survey and classification System (GUS)
- Part 5 Applications to several case studies

References

M. Rinaldi, A.M. Gurnell, B. Belletti, M.I. Berga Cano, S. Bizzi, M. Bussetтини, M. Gonzalez del Tanago, R. Grabowski, H. Habersack, M. Klösch, F. Magdaleno Mas, E. Mosselman, M. Toro Velasco, P. Veza (2015a) Final report on methods, models, tools to assess the hydromorphology of rivers, Deliverable 6.2, Part 1, of REFORM (REstoring rivers FOR effective catchment Management), a Collaborative project (large-scale integrating project) funded by the European Commission within the 7th Framework Programme under Grant Agreement 282656.

Rinaldi M., Belletti B., Bussetтини M., Comiti F., Golfieri B., Lastoria B., Nardi L., Surian N. (2015b) - *New tools for an integrated hydromorphological assessment of European streams*. D7.5 Conference Proceedings 'Novel Approaches to Assess and Rehabilitate Modified Rivers', 30 June - 2 July 2015, Wageningen (the Netherlands), 400-406.

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