FLEA **approach to ASSESS THE ECOLOGICAL STATUS OF RIVERS according to the WFD and to DEFINE an OPERATIONAL RIVER RESTORATION STRATEGY**

Andrea Nardini, *CIRF, mail:* direttore.tecnico@cirf.org
Giuseppe Sansoni, *CIRF, mail: sansoni@infinito.it*
Ileana Schipani, *CIRF, mail: i.schipani@cirf.org*
Bruno Boz, *CIRF, mail: b.boz@cirf.org*
Marco Monaci, *CIRF, mail: m.monaci@cirf.org*
Giulio Conte, *CIRF, mail: presidente@cirf.org*
Andrea Goltara, *CIRF, mail: a.goltara@cirf.org*

Abstract: *River Restoration (RR) is becoming more and more a key concept in river basin management by recognized that it aims at an environmental objective –improve the state of rivers in virtue of their existence value- and at the same time it is a means to achieve other important objectives like water supply, recreation and flood risk reduction; moreover, it paves the way to pursue economic efficiency because total costs on the long run can be reduced. The Water Framework Directive (WFD) requires moving towards a more integrated assessment of fluvial ecosystems which considers no longer only water quality. To this aim, it raises three problems: a) define the reference conditions/status (for each given eco-region and river typology); b) define parameters to assess the status and indicators to measure them; c) establish which value of such indicators which value of such indicators sets the class boundaries (from "bad" to "high") by ensuring an international comparability (inter-calibration problem). We propose a FLuvial Ecosystem Assessment scheme, named FLEA, to address problem b), which defines a "value tree" of the fluvial ecosystem, based on the WFD quality elements for rivers (biological, hydromorphological and physico-chemical), but integrating some additional key aspects now missing like the fluvial mobility strip, the riparian vegetation, and the "naturalistic relevance", an important component of the perceived value of a river: The scheme makes possible to build an evaluation index that can be used to measure the very objective of a RR strategy -that is "improving the value of rivers"- so supporting Strategic integrated evaluation of plans (SEA), including non strictly environmental aspects (e.g. costs). The scheme is sufficiently flexible to be adapted to the needs of the particular scale of analysis and case at hand (e.g. availability of data) as it relies on both quantitative and qualitative indicators. However, all indicators should be in principle objectively measurable providing a powerful basis to monitor river evolution (or involution) in a sistematic fashion. The scheme can be applied at different scales; for instance, at the regional scale quick and economic assessment can rely on secondary data available (e.g. water quality) and heavily on remote sensing (aero- photographs and satellite images), which supply information on wide areas with very good detail. The information can also be refined and updated at the local level by local authorities if suitably stimulated to collect and update the information as a pre-requisite to negotiate locally planning decisions made at the upper level.*

To measure and judge the deviation from the reference condition (problem c) and then to amalgamate/aggregate the indicators up to higher level indices, the powerful Value Function (VF) concept and operational tool is adopted. No matter the quantity of data available (even if hundred of thousand samples are taken and analysed), only the experts can judge to which quality class a given set of values of the selected indicators is to be assigned because a subjective value judgment is unavoidably involved. However, in order to guarantee repeatability and to make the instrument legally binding, a formalization of such judgments is required: the VF can do it as it is a mathematical representation of human preferences. On the other hand, it offers an interesting opportunity to by-pass the inter-calibration difficulty. Our reasoning is indeed as follows: assume that within a given eco-region (or within a country) a definition of the worst class of ecological status (i.e. "bad") is agreed upon, for a given river typology (the best –"high"- by definition is defined once the reference state is defined); then subdivide the full range of values of the VF (normally 0.00÷1.00) into 5 classes of equal width (e.g. associating 1.00÷0.80 with "high", 0.80÷0.60 with "good", and so on down to 0). Then, thanks to the very definition of VF, the meaning of the labels "high", "good", etc. would be comparable across countries; indeed,

what counts is the gross classification within the 5 classes (minor differences do have a scientific interest, but are probably irrelevant from a management point of view). Of course, building a FV is not an easy task, however it can be carried out within each single country (or –better- by the regulating subject within that eco-region and for that river typology) which has the freedom to select the indicators most suited to its case (depending on the working scale, data availability, and so on) –provided they are coherent with the WFD requirements.

We also present an application that develops a complete RR strategy in the Lombardia Region (STRARIFLU project, now part of its legally binding "Piano di Tutela", a regional plan for water bodies protection and management, according to national law 152/99, precursor of the WFD). The strategy builds on the river assessment to identify and measure both the "health gaps" and environmental strengths of river stretches, to define a zoning useful to orientate intervention, to specify what kind of action and at which scale to apply it, and to find synergies and potential contradictions deriving from other planning instruments to put into place countermeasures.

Mis en forme : Anglais Royaume-Uni