Geomorphological study of Magra and Vara rivers (Northern Italy) aimed to sediment management

C.Simoncini[1], M.Rinaldit[2]

[1] University of Florence, Department of Civil Engineering,, csimoncini@dicea.unifi.it,, Phone: +00-(39)-055-4796225
Florence, Italy
E-mail: : dir-dic@dicea.unifi.it
[2] University of Florence, Department of Civil Engineering,, mrinaldi@dicea.unifi.it,,
Florence, Italy

Introduction:
River management authorities in Italy rarely have addressed sediment transport and deposition processes, although more recently there has been an increasing awareness of regional sediment issues and channel morphodinamics being an integral part of river management plans. Consequently, there is a need to develop or further refine methodological approaches that include an assessment of sediment sources, transport, deposition and possible trends of channel evolution. The objective of this research project is to develop a methodology aimed to identify extent, severity and possible trends of instability processes (erosion, deposition) at the catchment scale, so to constitute a basic knowledge to support sediment management.

Methods: The methodology is intended to be specifically suitable in the Alpine – Apennine context, where channels are typically characterised by a relatively high sediment transport, with a braided or wandering morphology, characterised by abundant and large bars that can cause a wrong perception to river managers of generalised aggradational conditions.
The methodology includes three main modules:
(1) Historical and recent channel changes. The results of this phase will consist on an accurate reconstruction of past channel changes, identifying areas of higher channel instability, types of adjustments, rates of channel migration, etc.
(2) Sediment budgets. In order to quantify channel changes and responsible processes, sediment budgets can be conducted by three different ways. a) a budget by traditional hydraulic methods, based on standard sediment transport and continuity equations; b) budget by geomorphological methods, based on quantification of channel topography variations (by air photos, longitudinal profile, cross-sections and field measurements) and grain size surveys. We can combine this two approaches in order to obtain a sediment budget more representative of the real system. c) sediment budget based on photogrammetry. First and second approach are develop at basin scale, instead the last is applied in two representative reach of the system. Since the third approach can give more accurate results, we'll use this for calibrate the other methods.
(3) Classification system of instability processes and conceptual model of channel evolution. This phase includes the following aspects: a) selection of a series of diagnostic variables (from field or aerial photos) for identification of the type of process (incision, aggradation, channel narrowing or widening, etc.), with particular focus on sedimentation processes; b) definition of specific sheet forms for field data collection and definition of a series of indices of erosion, transfer and deposition of sediment; c) development of a conceptual model of channel evolution specific for the two geographic contexts. Management and analysis of data is performed by GIS.

Results: The expected result is the definition of an overall methodology, consisting in a series of integrated (hydraulic and geomorphological) modules for data collection, analysis and interpretation, that can be extended to other study cases and adopted by public agencies as a decision-making support for sediment management at basin scale.

References: [1] Barker R. et al (1997) *Use of terrestrial photogrammetry for monitoring and measuring bank erosion* Earth Surface Processes and Landforms, 22, 1217-1227; [2] Bunte K. & Abt, S.R. (2001) *Sampling surface and subsurface particle-size distributions in wadable gravel- and cobble-bed streams for analyses in sediment transport, hydraulics, and streambed monitoring* U.S.Department of Agriculture, Forest Service, Rocky Mountain Research Station, General Technical Report RMRS-GTR-74, 428 pp; [3] Church M.et al (2001) *Gravel management in lower Fraser river. Final report for the city of Chilliwack*, http://www.geog.ubc.ca/fraserriver/publications.html, 110 pp; [4] Liebault F. & Piegay H. (2002) *Causes of 20th century channel narrowing in mountain and piedmont rivers of southeastern France* Earth surface processes and landforms, 27, 425-444; [5] Thorne, C.R. (1998) *Stream reconnaissance handbook. Geomorphological investigation and analysis of river channels* Wiley, Chichester, 133 pp.