Decision support methodology to establish priorities on the inspection of structures

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For hydro-meteorological hazards in mountain areas, the regular inspection of check dams and bridges is important due to the effect of their functional status on water-sediment processes. Moreover, the inspection of these structures is time consuming for organizations due to their extensive number in many regions. However, trained citizen-volunteers can support civil protection and technical services in the frequency, timeliness and coverage of monitoring the functional status of hydraulic structures. Technicians should evaluate and validate these reports to get an index for the status of the structure. Thus, preventive actions could initiate such as the cleaning of obstructions or to pre-screen potential problems for a second level inspection.

This study proposes a decision support methodology that technicians can use to assess an index for three parameters representing the functional status of the structure: a) condition of the structure at the opening of the stream flow, b) level of obstruction at the structure and c) the level of erosion in the stream bank. The calculation of the index for each parameter is based upon fuzzy logic theory to handle ranges in precision of the reports and to convert the linguistic rating scales into numbers representing the structure's status. A weighting method and multi-criteria method (Analytic Hierarchy Process- AHP and TOPSIS), can be used by technicians to combine the different ratings according to the component elements of the structure and the completeness of the reports. Finally, technicians can set decision rules based on the worst rating and a threshold for the functional indexes.

The methodology was implemented as a prototype web-based tool to be tested with technicians of the Civil Protection in the Fella basin, Northern Italy. Results at this stage comprise the design and implementation of the web-based tool with GIS interaction to evaluate available reports and to set priorities on the inspection of structures.