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Management of reservoirs: sediment flushing

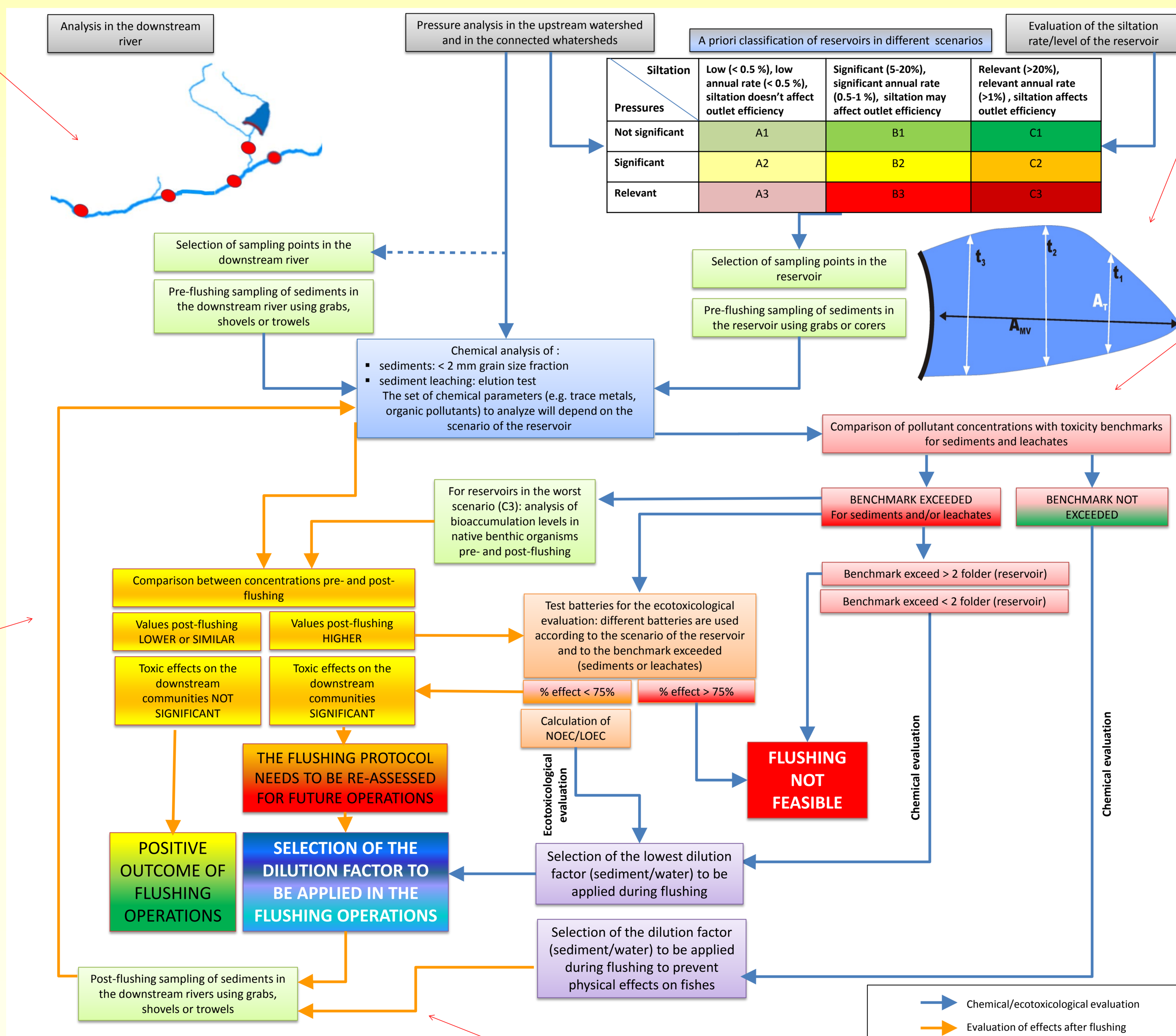
Reservoirs are often characterized by high siltation rates which impair the storage capacity. Accumulated sediments are frequently removed by flushing, causing **physical-mechanical impacts on aquatic organisms in the downstream rivers**. In some cases chemical compounds (organic and metals) adsorbed on sediments may induce **toxic effects**, mainly in a long-term perspective.

PrATo: a Protocol for the Assessment of sediment Toxicity in reservoirs

PrATo is a protocol designed for assessing the toxic potential of sediments released downstream and includes methods for sampling, chemical analysis and ecotoxicological evaluation of sediments, as well as **criteria for risk assessment, based on cross-interpretation of results deriving from chemical and ecotoxicological analyses**. Drawbacks deriving from the first trials of the protocols in Northern Italian reservoirs are highlighted.

The number of sampling stations in the downstream river should be evaluated according to the sediment deposition dynamics.

The number of the sampling stations should be between 3 and 13 according to the reservoir scenario: are these stations enough to represent the distribution of pollutants in the lake sediments? Trials in mountain reservoirs showed that core sampling is not always possible because of difficulties in transportation of the sampling devices. Are grab samples an alternative in these cases to characterize the sediment toxic potential?



Toxicity benchmarks were selected from the literature (MacDonald et al. (2000) and from Italian legislation (e.g. DL 152/2006, DM 5/04/2006). The selection of effective benchmarks may be biased by high natural background values (i.e. trace metals), by synergistic effects of pollutants. Therefore, we concluded that pre-flushing toxicity bioassays are essential to define the toxic potential of sediments: the chronic test with *Heterocypris incongruens* was selected as preliminary tests for sediment toxicity assessing in all reservoirs before flushing.

A TRIAD analysis is carried out to evaluate the effects of flushing in the downstream river: for this evaluation the best sampling timing pre- and post-flushing needs to be further tested.

The potential re-depositions of the flushed sediments in the downstream river should be further evaluated using site-specific hydrological models.

Outcomes

The PrATo protocol may help **decision makers evaluating the possible toxicological impact of reservoir contaminated sediments during flushing events**. The development of a method for **cross-interpretation of analytical results deriving from chemical and ecotoxicological analyses** provides a practical and efficient tool ensuring a sustainable **management of the flushing activities**. The trial of the PrATo in some Italian reservoirs will allow the validation the proposed protocol.

References:

MacDonald D.D., Ingersoll C.G. and Berger T.A. (2000), Development and evaluation of consensus-based sediment quality guidelines for freshwater ecosystems, *Arch. Environ. Contam. Toxicol.*, **39**: 20-31.