



Assessing floodplain restoration potential through the re-use of hydropower peaking waves into nearby agricultural ditch networks

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The ecological impacts of hydropeaking have been broadly investigated, and several mitigation procedures have been proposed and implemented worldwide. In Alpine valleys, freshwater habitat reduction has been particularly severe in agricultural areas, where milder environmental conditions have favored human activities and infrastructures. This loss is particularly important as valley bottoms frequently hosted very diverse and ecologically productive lotic and lentic ecosystems. Most of these natural habitats have been replaced by connected networks of artificial drainage ditches.

The present work aims to assess the potential of restoring the freshwater ecosystem in an agricultural floodplain located downstream of a large hydropower plant in the lower Noce Basin (Italian Alps). The research idea is to re-use part of the downstream plant release the network of agricultural ditches. This is expected to improve several lost ecosystem benefits, among which the freshwater habitat quality, the surface – subsurface water exchanges and biodiversity richness.

To test this option, an ecohydraulic research is presently conducted in 21 ditches in a 30 km² agricultural area. The network has been characterized by integrating historical with recently collected topography data, together with information on ditches cover for roughness estimation. The network hydrodynamic response to the upstream input of a hydropeaking wave has been simulated through 1D unsteady flow model supported by local hydraulic measurements.

Biological and environmental parameters have been assessed under present conditions and results indicate a large variability of habitats. The main environmental parameters which negatively affect biodiversity are low discharge and water velocity values, and the highly variable water temperature. The possibility to simulate the hydraulic behavior of the network allows to forecast the possible changes in the biota in the entire ditch system, thus providing a first assessment of the potential restoration benefits.

Because the floodplain ditches network represents a proxy for wetlands, the present ecohydraulic research can provide quantitative support to optimize water resources management in areas with flow regulation downstream of dams through the reuse of part of the hydropeaking waves.