

Effects of releasing fine sediment from the reservoir on river morphology

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Abstract

Hydropower is one of the most interesting types of renewable energy sources in most countries. According to the 2001/77 (RES-e Directive), European countries must increase their share of renewable electricity production. To enhance the use of water energy, the first step is the construction of dams on the rivers. Construction of dams will inundate a large area upstream and change the flow patterns, as well as the morphology of the river upstream and downstream of the dam, and consequently have environmental impacts.

Accumulation of sediments in the reservoir gradually reduces the active capacity of the reservoir. In addition, sediment trapping behind the dam reduces the sediment input to the downstream river. This, combined with changes of sediment transport capacity of the river leads to morphological changes downstream of the dam.

To increase the life of the dam and decrease the negative impacts of damming, it is necessary to find a good sediment-water management strategy allowing to increase the productive life of the reservoir as well as electricity generation, to keep enough capacity for flood protection and to mitigate the impact on the downstream river morphology and ecosystem.

In this study different scenario of sediment releases are studied, for the Piave River, Italy, and the Shirin Dareh River, Iran. A 1-D morphological model accounting for different sediment sizes, designed for applications on mountain rivers, is applied to simulate different amounts of water and sediment release to downstream. For the Piave River, the work investigated the possibility of releasing fine sediment, which is deposited in the last part of reservoir near the dam, with the environmental flow. This is the minimum discharge that should be released to the river according to the Italian law and is 10% of the averaged annual river discharge. Releasing of fine sediment with low flows is based on the idea of maintaining suspended sediment concentrations within acceptable limits for the aquatic environment.

Due to lack of data, the release of sediment in the Shirin Dareh River was only studied on a steep reach upstream of Shirin Dareh Dam, with the only aim of comparing the response of two different water courses to this type of operation.

Due to different catchment's characteristics, (high slope and finer sediment in Shirin Dareh River compare with milder slope with coarser sediment in Piave River), although similar scenarios (with difference in parameter