



Economic interpretation of environmental flow regime downstream diverted river reaches.

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Water demand for hydropower production is increasing together with the consciousness of the importance of riparian ecosystems and biodiversity. Some Cantons in Switzerland and other alpine regions in Austria and in Sud Tirol (Italy) started replacing the inadequate concept of Minimum Flow Requirement (MFR) with a dynamic one, by releasing a fix percentage of the total inflow (e.g. 25 %) to the environment. In the same direction Perona et al. (in revision) mathematically formulated a method particularly suitable for small hydropower plants, handling the environment as a non-traditional water use, which competes with exploitators. This model uses the Principle of Equal Marginal Utility (PEMU) as optimal water allocation rule for generating like-natural flow releases while maximizing the aggregate economic benefit of all uses (Gorla and Perona, in revision).

In this paper we show how redistribution policies can be interpreted in terms of PEMU, particularly we focus at traditional water repartition rules, such as the MFR, but also to dynamic ones like proportional redistribution. For the first case we show both ecological and economical arguments suggesting its inappropriateness; in the second case we highlight explicit points of strength and weakness, and suggest ways of improvement. For example the flow release allocation rule can be changed from inflow-independent ones (e.g., proportional redistribution), to inflow-dependent ones (e.g., non-proportional). The latter, having fewer constraints, can generally lead to better both ecological and economical performances. A class of simple functions, based on the PEMU, is then proposed as a suitable solution in run-of-river or small hydropower plants.

Each water repartition policy underlies an ecosystem monetization. We explicit the value of the ecosystem health underlying each policy by means of the PEMU under a few assumptions, and discuss how the theoretic efficient redistribution law obtained by our approach is feasible and doesn't imply high costs or advanced management tools. Our approach is a simple but effective step towards eco-sustainability in the growing market of mini hydropower plants, where operation rules like MFR are still widespread. As such, this method is a powerful instrument for political managers to explicit contradictions thus enlightening best compromise measures/decisions.

References

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