



Designing and assessing weather-based financial hedging contracts to mitigate water conflicts at the river basin scale. A case study in the Italian Alps

Laura Bellagamba (1), Simona Denaro (1), Jordan Kern (2), Matteo Giuliani (1), Andrea Castelletti (1), and Gregory Characklis (2)

(1) Politecnico di Milano, Electronics, Information, and Bioengineering, Milano, Italy, (2) University of North Carolina at Chapel Hill, Department of Environmental Sciences and Engineering, Chapel Hill, NC, USA

Growing water demands and more frequent and severe droughts are increasingly challenging water management in many regions worldwide, exacerbating water disputes and reducing the space for negotiated agreements at the catchment scale. In the lack of a centralized controller, the design and deployment of coordination and/or regulatory mechanisms is a way to improve system-wide efficiency while preserving the distributed nature of the decision making setting, and facilitating cooperation among institutionally independent decision-makers. Recent years have witnessed an increased interest in index-based insurance contracts as mechanisms for sharing hydro-meteorological risk in complex and heterogeneous decision making context (e.g. multiple stakeholders and institutionally independent decision makers). In this study, we explore the potential for index-based insurance contracts to mitigate the conflict in a water system characterized by (political) power asymmetry between hydropower companies upstream and farmers downstream. The Lake Como basin in the Italian Alps is considered as a case study. We generated alternative regulatory mechanisms in the form of minimum release constraints to the hydropower facilities, and designed an insurance contract for hedging against hydropower relative revenue losses. The fundamental step in designing this type of insurance contracts is the identification of a suitable index, which triggers the payouts as well as the payout function, defined by strike level and slope (e.g., euros/index unit). A portfolio of index-based contracts was designed for the case study and evaluated in terms of revenue floor, basis risk and revenue fluctuation around the mean, both with and without insurance. Over the long term, the insurance proved to be capable to keep the minimum revenue above a specified level while providing a greater certainty on the revenue trend. This result shows the possibility to augment farmer's supply with little loss for hydropower companies, thus helping in mitigating the conflict between the stakeholders.