Effects of Interactions Between Society and Environment on Policy in Water Resources Management: Exploring Scenarios of Natural and Human-Induced Shocks

Iolanda Borzì¹,², Murugesu Sivapalan³, Brunella Bonaccorso¹, and Alberto Viglione⁴

¹University of Messina, Messina, Italy (iborzi@unime.it)
²Currently Visiting at Vienna University of Technology, Vienna, Austria
³University of Illinois, Urbana-Champaign, USA
⁴Polytechnic of Turin, Turin, Italy

In many regions of the world, water supply is threatened by natural hazards such as floods and droughts, as well as by shocks induced by anthropogenic changes to water use. Lack of anticipation and/or preparation for these events can lead to delayed or insufficient responses to sudden or developing water crises, that sometimes can produce irrecoverable damage to the environment. In this work, a socio-hydrological approach to sustainable water resources management of the Alcantara River Basin in Sicily (Italy) is adopted that explicitly takes into account feedbacks between the natural and the human components that might arise from shocks to the water management system, including possible evolution of policy responses. The Alcantara River Basin is a groundwater-fed catchment which supplies many villages on the Ionian coast up to Messina city, mainly through the Alcantara aqueduct, but also agricultural areas and industries, including hydropower plants. It also hosts the Alcantara Fluvial Park, an important natural reserve. The Alcantara aqueduct also supplied the city of Messina during a temporary failure of its main aqueduct caused by a landslide in October 2015. The main purpose of the work is to use the socio-hydrological model as a “screening tool” to frame water resource management issues in a broad way and provide guidance to the community to identify aspects of societal behavior that need to evolve towards sustainable water resource management in order to withstand future shocks. This has been done by scenario simulations in conditions of a natural shock affecting the system (i.e. drought) and of a human-induced one (i.e. increase in groundwater extraction). Sensitivity analysis of the model social parameters revealed how the value attributed by the society to the environment and water resources use, its capacity to remember previous water crises and, in particular, its previous responses to shocks, can affect the system in a way that can produce paradoxical effects. Results show how a rapid decision-making strategy that may work in the short term, can be counter-productive when viewed over the long term and how a do-nothing decision during a water crisis could be highly damaging to the environment. For the above-mentioned reasons, this socio-hydrological approach can be considered as a useful tool to understand human-water dynamics and to support decision-makers in water resource management policies with a broad and long-term perspective.