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Ecological flow assessment in a non-perennial river under climate variability: the case study ofthe Lake Ancipa

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In 2012 the European Commission launched a Blueprint to Safeguard Europe's Water Resources to foster the sustainable use of water resources in agreement with the Water Framework Directive (WFD2000/60/EC). The document introduced the concept of Ecological Flow defined as the amount of
water to be maintained in a river to ensure good (or optimum) conditions for the existing ecosystems. By definition, the Ecological Flow is associated with the quality status, the hydrological regime and the morphological dynamics of the river.

In the present study a methodology for Ecological Flow assessment in a non-perennial river, established by Decree n. 30/STA 2017 of the Ministry of the Environment and Soil and Sea Conservation, is implemented. The proposed methodology is based on the monthly flow duration curve from which threshold flows are defined by the so-called Aquatic States, i.e., the set of habitats occurring on a given stream reach at a given time, depending on the hydrological conditions.

The methodology was applied to evaluate the Ecological Flow downstream of the Ancipa reservoir along the Troina river, a tributary of the Salso-Simeto river basin system in Eastern Sicily.

Monthly streamflow data used for the flow duration curve, were estimated using both a non-linear regressive model and an artificial neuronal network, calibrated and validated on monthly rainfall data and average temperature data retrieved by the BIGBANG database developed by the Italian Institute for Environmental Protection and Research (ISPRA), as well as on inflow data estimated through the reservoir water balance between 1956 and 2002. The best-performing model was therefore used to extend monthly inflow data up to 2019, using contemporary values of rainfall and temperature. Then, the monthly flow duration curve was constructed and threshold values of Ecological Flows were derived, after fitting a gamma probability distribution.

Finally, the effect of climate variability on the threshold flow values corresponding to a duration of 10 days, Q10, was analysed by means of a 30-year moving window. The results show a clear decreasing trend of Q10 values, which can be largely explained by the increase in average temperature
and, in turn, in the lake evaporation.

Further research is ongoing to assess future changes in the Ecological Flow values by forcing the proposed model with projected meteorological inputs provided by Regional Climate Models.