Modeling the climate change effects on habitat availability in Alpine watercourses

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**Abstract:** Alpine watercourses are impacted by significant human exploitation, often leading to significant negative pressures upon the aquatic ecosystems. Moreover, conflicts among different water users, e.g., hydropower, agriculture, drinking water, and ecological needs, will probably increase in the future due to the effects of climate change on water availability.

In Aosta Valley (North-Western Italy), the water withdrawal licenses of several hydropower plants will be revised over the next years, redefining, among other terms, the environmental flow requirements for a 30-year period. At such time scale, the potential effect of climate change on water and habitat availability must be accounted for. Therefore, the aim of this study was to identify an adequate modeling approach to quantify the possible effects of climate change on the hydrology and river habitats of representative mountain watercourses in the region, in order to support the decision-makers in the upcoming revision process of the water withdrawal licenses.

Historical and future flow time series were modeled under different greenhouse gas scenarios both for the near future (2041-2060) and the far future (2080-2099), using a relatively simple rainfall-runoff model (TUWmodel). Moreover, the MesoHABSIM (Mesohabitat Simulation Model) methodology was used to simulate the variations in habitat availability for the local fish population (brown and marble trout). This combined approach allowed to obtain habitat availability time series for different climate change scenarios by combining a quantitative assessment of river habitats and the modeled flow time series. The results of the hydrological modeling showed significant changes in future runoff regimes for the considered watercourses (increased winter discharges and reduced summer discharges), with consequent impacts on the habitat availability varying across fish species, seasons, and life stages. The initial results showed that the combined modeling approach has potential in supporting water resources management and the decision-making process in the near future.