Extending meso-scale habitat models to temporary rivers: possible approaches and software applications

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Temporary rivers (TRs) are ubiquitous and becoming more and more common in this era due to the combined effect of climate change and increasing water demand. In different areas of Europe, the increased future probability of rainfall deficit (seasonal or multi-year droughts) elevates the probability of flow intermittency in a large portion of the territory, in both natural and regulated rivers. However, our ability to incorporate flow intermittency (non-flow events) into existing habitat modelling methods is limited by the lack of available approaches and software applications.

In this study, we extended the Meso-HABitat SImulation Model (MesoHABSIM) to TRs and we find that mesohabitat methods are particularly effective for describing complex habitat dynamics during dry phases. We present examples of applications in Italy and Spain to show the relationship between discharge, non-flow days, wetted area, habitat suitability and longitudinal connectivity. The total amount of channel area submerged by water and the habitat availability for fish were quantified at the reach scale, taking into account both flowing and non-flowing phases. Spatio-temporal variation of habitat availability was assessed by means of a so-called habitat-flow-time rating curve and habitat time series.

In addition, we present a specific module of the SimStream software that deals with habitat modelling in temporary rivers. The module is integrated in a web service and it allows to obtain, for TRs, the following outputs: (1) the habitat availability, over space and time, for target species (or life stages) of interest. In particular, the service generates the geo-referenced habitat maps in a shapefile format, the habitat-flow rating curves and the habitat time series. (2) The Habitat Integrity Index (IH) associated with one or more hydrological or morphological management scenarios at the reach, segment or catchment scale.