Flood events as restoration tools

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Flow regulation impacts not only the hydrology of gravel bed rivers but their morphology, riparian vegetation and vertical connectivity with the hyporheic zone. Thus, their impact on the ecosystem and the distribution of aquatic habitat quality goes beyond the mere change in the amount and timing of water. Here, we present the results of a study that tested whether large floods, as a disturbance, have positive or negative impact on aquatic habitat distribution. Our premise is that large floods change the overall streambed morphology with noticeable implications on surface hydraulic, hyporheic exchange, aquatic habitat quality distribution and riparian zone. Large floods may re-set lateral and vertical connectivity and habitat. Here, we document and analyze the impact of a nearly 25-year return period flood on river morphology, aquatic habitat, and hyporheic flow distribution and show the beneficial impact of such events in regulated streams. We collected pre and post flood topographies, riparian vegetation distribution and we run a set of surface and subsurface numerical models to map the surface and hyporheic hydraulics. Results show that the large flood reshaped the in-channel morphology, forming deeper pools and enhancing the complexity of the flow field by scouring around large boulders, and forming new bars both lateral and in the middle of the channel. The overall habitat quality improved the habitat suitability for the endemic Eastern Iberian chub (Squalius valentinus) and one invasive species (common bleak Alburnus alburnus), whereas habitat quality for the invasive species pumpkinseed (Lepomis gibbosus) only experienced neglegible changes. Hyporheic exchange did not show noticeable change, because the reach is notably losing such that most of the hyporheic flow only downwells to the aquifer. However, the hyporheic flow model also indicated that if the system would be neutral (not gaining or loosing), then the flood would have increased the hyporheic exchange fluxes in the study site. This study corroborates the beneficial effect that high floods have on Mediterranean rivers of the Iberian Peninsula.