



Co-evolution of in-channel sediment deposition and channel widening. The case of the gravel-bed Dunajec River upstream from the Czorsztyn Reservoir, Polish Carpathians.

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In this study the changes of the gravel bar area and the channel width were analysed in the base-level raised section of the gravel-bed Dunajec River upstream from the Czorsztyn Reservoir (CR) (Polish Carpathians). The construction of the CR and the large flood which occurred in 1997, as well as the existence of aerial imagery taken before (1982, 1994) and after (2003) those events during very similar and low river discharges, provided unique opportunity to investigate temporal and spatial changes of channel width and bar area.

In the post-dam period (1994-2003), a major flood in 1997 caused more than two times greater channel widening and ten-fold greater bar area increasing in the backwater section than in the section not affected by base-level rising. The extents of accelerated channel widening and bar area growing in the longitudinal channel profile reached 2400 m and 1800 m upstream from the CR respectively. The highest channel widening and the bar growth were spatially related to the highly developing meander bends located partly at the upstream limit of the backwater (1400-2400 m). In this section, very wide braided channel existed at end of the 19th century.

This study shows that the reservoir-induced base-level rising may have promoted the sediment storage and major channel change, but the trajectories of these phenomenons are temporally related to floods, and spatially and casually interdependent on local site specific conditions (e.g. bend development site in wider valley bottom section). In this site the existence of negative feedback mechanisms between bar growth and channel widening resulted in a progressive channel widening and large bar development.