

Large flood on a mountain river subjected to restoration: effects on aquatic habitats, channel morphology and valley infrastructure

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The Biała River, Polish Carpathians, was considerably modified by channelization and channel incision in the twentieth century. To restore the Biała, establishing an erodible corridor was proposed in two river sections located in its mountain and foothill course. In these sections, longer, unmanaged channel reaches alternate with short, channelized reaches; and channel narrowing and incision increases in the downstream direction. In June 2010 an 80-year flood occurred on the river; and this study aims at determining its effects on physical habitat conditions for river biota, channel morphology, and valley-floor infrastructure. Surveys of 10 pairs of closely located, unmanaged and channelized cross sections, performed in 2009 and in the late summer 2010, allowed us to assess the flood-induced changes to physical habitat conditions. A comparison of channel planforms determined before (2009) and after (2012) the flood provided information on the degree of channel widening as well as changes in the width of particular elements of the river's active zone in eight stretches of the Biała. The impact of the flood on valley-floor infrastructure was confronted with the degree of river widening in unmanaged and channelized river reaches. Before the flood, unmanaged cross sections were typified by finer bed material and greater lateral variability in depth-averaged and near-bed flow velocity than channelized cross sections. The flood tended to equalize habitat conditions in both types of river cross sections, obliterating differences (in particular physical habitat parameters) between channelized and unmanaged channel reaches. River widening mostly reflected an increase in the area of channel bars, whereas the widening of low-flow channels was less pronounced. A comparison of channel planform from 2009 and 2012 indicated that intense channel incision typical of downstream sections limited river widening by the flood. Active channel width increased by half in the unmanaged cross sections and by one-third in the channelized cross sections. However, damage to the valley-floor infrastructure was practically limited to the channelized river reaches with reinforced channel banks. This indicates incompetent management of riparian areas rather than the degree of river widening as a principal reason for the economic losses during the flood.

This study was performed within the scope of the Research Project DEC-2013/09/B/ST10/00056 financed by the National Science Centre of Poland.