Environment-friendly reduction of flood risk and infrastructure damage in a mountain river: case study of the Czarny Dunajec

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The Czarny Dunajec drains the Inner Carpathians in southern Poland (1). Its unmanaged, multi-thread reaches exhibit high hydromorphological quality, support a relatively rich biocenosis and trap substantial amounts of woody debris, preventing its further transfer to urbanised valley reaches (2). To arrest erosion of a laterally migrating channel and protect a nearby road, water authorities planned construction of a ditch with reinforced banks and damming the main channel with a boulder groyne (2). The channelization would deteriorate the ecological status of the reach and increase flood risk to downstream reaches.

A different solution to the erosion risk to the road was thus proposed, aiming to open the inlets to inactive braids located by the neck of the bend of the main channel (3). Directly below the inlets to the reactivated side channels, gravelly deflectors were constructed to divert the flow into the channels and prevent the water from entering the main channel (3). The scheme, re-establishing the flow in the steeper side channels, was applied in the autumn 2001 with the budget of 9000 euro.

After the scheme implementation, the river cross-sections located at the upstream end and in the middle of the main channel bend (4) were surveyed to compare the hydraulic characteristics of flow (5) and the composition of fish (7) and benthic invertebrate communities (8) with those recorded prior to the project. The hydraulic measurements confirmed that the scheme allowed to shift the main water current, with the highest average velocity and bed shear stress, from the right braid closest to the road to the left, most distant one (5). This should lead to a natural cut-off of the main channel and its abandonment during the next flood. The biotic surveys documented an increase in the number of fish species (7) and benthic invertebrate taxa (8) in comparison with the situation before the scheme implementation.

The implemented solution:
- effectively changed the hydraulic pattern
- enhanced ecological functions of the multi-thread channel
- maintained the role of the reach as wood debris trap
- was significantly less expensive.