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Effect of large wood retention at check dams on sediment continuity

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Large wood transport during flood events may seriously increase the damage potential due to accumulations at river infrastructures. The large wood is therefore mostly retained upstream of populated areas using retention structures that often combine a check dam with a debris rack. One disadvantages of this structures is, that the bed-load gets retained along with the wood. Especially if large wood blocks the rack early during a flood event, sediment continuity is completely interrupted. This may lead to severe bed erosion downstream of the check dam. So far, no common design to retain large wood but maintain sediment continuity is available.

One attempt to separate the large wood from the bed-load was made with the large wood retention structure at River Sihl in Zürich, Switzerland. The retention of the large wood occurs in a bypass channel located along the main river. The bypass is located at an outer river bend, where a separation of bed-load and large wood results due to the secondary currents induced by the river curvature. Large wood floats towards the outer bend due to inertia and the secondary currents whereas bed-load remains at the inner bend. The bypass is separated by a side weir from the main river to ensure that the bed-load remains in the river during bed forming discharges and flood events.

New model test are currently carried out at the Laboratory of Hydraulics, Hydrology, and Glaciology (VAW) of ETH Zurich, where sediment continuity should be achieved using an inclined rack. The rack is inclined in flow direction with a degree of 45° to 20°. First results show that the large wood deposits at the upper part of the rack whereas the lower part of the rack remains free for bed-load transport. Furthermore, the backwater rise for the inclined rack due to the accumulated wood is considerably reduced compared to a vertical rack, as a large part of the rack remains clear for the flow to pass.

The findings of this studies help to understand the complex interaction between sediment and large wood at a check dam retention structure. Furthermore, new retention structures and rack designs are available, where sediment continuity can partially be maintained to reduce downstream bed erosion.