

## **Upstream effects of dams on alluvial channels: state-of-the-art and future challenges**

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More than 50,000 large dams (with the height above 15 m) operate all over the world and, thus, they significantly disturb water and sediment transport in river systems. These disturbances are recognized as one of the most important factors shaping river morphology in the Anthropocene. Downstream effects of dams have been well documented in numerous case studies and supported by predictions from existing models. In contrast, little is known on the upstream effects of dams on alluvial channels. This review highlights the lack of studies on sedimentological, hydromorphological and biogeomorphological adjustments of alluvial rivers in the base-level raised zones of backwater upstream of dam reservoirs where water level fluctuations occur. Up to date, it has been documented that backwater effects may facilitate fine and coarse sediment deposition, increase groundwater level, provide higher and more frequent channel and floodplain inundation and lead to significant morphological changes. But there have been no studies quantifying short- and long-term consequences of these disturbances for the hydromorphological and biogeomorphological feedbacks that control development of alluvial channels. Some recent studies carried out on gravel-bed and fine-grained bed rivers show that the above mentioned disturbances facilitate vegetation expansion on exposed channel sediments and floodplain influencing river morphology, which suggests that backwater area of alluvial rivers may be treated as the hotspot of bio-geomorphological changes in a fluvial system. To set the stage for future research on upstream effects of dams, this work presents the existing state-of-art and proposes some hypotheses which may be tested in future studies.

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