Incorporating continuous measurement of sediment transport into large river management: Case study on the Yampa and Little Snake Rivers

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Recovery programs often modify reservoir releases to restore a natural pattern of hydrology or to achieve downstream ecosystem objectives for endemic endangered fish. The success of such programs may be limited, however, if there is not an explicit consideration of how the modified flow releases affect sediment transport in the river system. In the past, measuring sediment transport was time consuming and difficult. However, new technologies to continuously measure sediment transport now exist and are being used by managers in the upper and middle Green River and the Yampa River. Such measurements allow managers to quantify the magnitude of sediment stored or evacuated by different flows. From a management perspective, however, where sediment accumulates or evacuates within the channel and the associated changes in habitat might be of greater interest than the absolute magnitude. Thus, there is a need to understand how measurements of sediment storage or evacuation relate to channel change in order to develop recommendations for a natural, or balanced, sediment regime, similar to that of the flow regime. Here, we present a framework to link continuous measurements of sediment transport to observed channel change on the Yampa and Little Snake Rivers. We found that sand was eroded during every spring flood since 2013, but interestingly, the magnitude of sand erosion did not scale with the magnitude or duration of the annual flood. Instead, larger floods produced a smaller amount of erosion because vegetated islands and floodplains were inundated and accumulated very fine sand. We found that the measured net evacuation of sand did not cause the channel to widen, because bank erosion was balance by vegetated island and floodplain expansion. In future work, we will perform a similar analysis on the upper Green River to characterize the spring flow release from Flaming Gorge Dam that is needed to prevent future channel narrowing.