
109-6 - THE IMPACT OF LARGE FLOODS ON FLUVIAL SYSTEMS IN NORTHERN YELLOWSTONE NATIONAL PARK: CLIMATIC, VEGETATIVE, AND GEOMORPHIC CONTROLS



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605 (*Colorado Convention Center*)

Abstract

From June 10-13 2022, an atmospheric river delivered 2.5-10 cm of rain to the high-elevation snowpack around northern Yellowstone National Park (YNP). The resulting floods caused major bank erosion and extensive damage to roads as peak discharges on at least four stream gages on the Yellowstone River and its tributaries well exceeded the flood of record. Previous extreme floods in 1918, ca. 1873, and possibly ca. 1790 are evidenced by extensive overbank gravels and tree-ring dating. As in 2022, the 1918 flood was generated by rapid warming and heavy rain on melting snow in June. The frequency and severity of floods caused by rain-on-snow events may be increasing in YNP because of climate change, as the high-elevation snowpack becomes more susceptible to rapid melting and late spring precipitation shifts from snow to rain. Major channel changes including widening occurred in the historic floods, including in smaller 1996 and 1997 floods then considered ~100-yr RI events.

Some studies suggest that riparian vegetation is the dominant control on modern channel form in YNP, as the loss of wolves has allowed elk overbrowsing of willows, lowering bank stability and reducing overbank flood frequency via channel incision. Analysis of the 2022 flood impacts must consider prior large flood effects and vegetative controls to determine the relative contribution of these factors on channel and floodplain changes. We will use geomorphic mapping and channel cross-section resurveys to estimate 2022 flood discharges and characterize the amount and reach-scale variations of channel change. Flood magnitude estimates will be compared to 1918 discharge reconstructions and maximum recorded discharges relative to basin area in the YNP region. The historic fluvial record indicates that channel changes are not overwhelmingly controlled by vegetation, and that differences in geologic and geomorphic controls must be considered in comparing impacts between reaches. Longer-term fluvial system changes have been substantially driven by Holocene climate fluctuations, highlighting the sensitivity of these systems to further impacts by anthropogenic climate change.

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