

Debris Flow Chronology and Analysis of Controls on Debris Flow Occurrence in the Upper Colorado River Valley, Rocky Mountain National Park, CO

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Abstract. The role of debris flows along the upper Colorado River was recently highlighted when the Grand Ditch, a 19th century water-conveyance ditch, overtopped from snowmelt and triggered a large debris flow along Lulu Creek, a tributary of the Colorado. Historical aerial photographs indicate that multiple debris flows have been triggered from the Grand Ditch over the last century. This study aims to determine whether the Grand Ditch has increased magnitude and frequency of debris flow occurrence from the west side of the Colorado River valley, as compared to the unimpacted east side. Ten distinct debris flows were mapped using aerial photographs and field exploration, dated from tree cores and tree scars, and analyzed for magnitude using heights of tree scars and estimated volumes of deposition. Forty scarred survivor trees and 38 cores from even-aged stands were dated, with corresponding debris flow dates ranging from 1923 to 2003. Six of the ten debris flow deposits are on the west side of the valley, with the largest along Big Dutch Creek containing an estimated 50,000 m³ of sediment and dating to 1952. Additional factors used to evaluate controls on debris flow occurrence were basin area, hydrothermal alteration of source rock, slope, and aspect, with basin area emerging as a strong control. Although the debris flow record is limited by frequent disturbance and burial of older deposits, and estimates of magnitude have high uncertainty, these data suggest that the Grand Ditch has contributed to the occurrence of larger and more frequent debris flows.