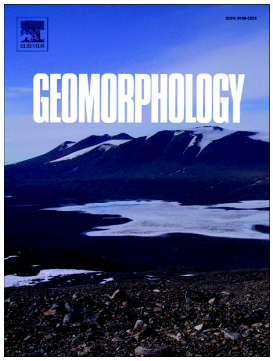

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PII: S0169-555X(16)30879-0
DOI: doi: 10.1016/j.geomorph.2017.03.030
Reference: GEOMOR 5977

To appear in: *Geomorphology*

Received date: 15 September 2016
Revised date: 28 March 2017
Accepted date: 29 March 2017

Please cite this article as: Will Wicherski, David P. Dethier, William B. Ouimet , Erosion and channel changes due to extreme flooding in the Fourmile Creek catchment, Colorado. The address for the corresponding author was captured as affiliation for all authors. Please check if appropriate. Geomor(2017), doi: 10.1016/j.geomorph.2017.03.030

Erosion and channel changes due to extreme flooding in the Fourmile Creek catchment, Colorado

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Abstract

Infrequent, large magnitude geomorphic events generate quantifiable change on geologically short timescales and are crucial to understanding landscape evolution. Airborne lidar surveys and field measurements were used to investigate floodplain erosion and deposition along a 19.5 km reach of Fourmile Creek, Colorado that was devastated by severe flooding in 2013 that followed a 2010 wildfire. More than 350 mm of rain fell on the Fourmile catchment from September 9-15, 2013, generating discharge that exceeded bankfull for >120 hr at the Orodell gage, with unit stream power >300 W m^{-2} throughout the study reach. Debris flows occurred on steep hillslopes and tributary channels in the most intensely burned areas. Lidar difference measurements and field studies highlight zones of local deposition along the study reach, but demonstrate overall net erosion of ~0.25 m for the 19.5 km reach of Fourmile floodplain, mainly by channel widening. Tributary junctions where debris-flow sediment entered the floodplain and local decreases in unit stream power controlled some zones of deposition. Overall, mass balance calculations show that a total sediment loss of ~91,000-161,000 m^3 from the Fourmile Creek floodplain and hillslopes, which is broadly consistent with channel