Geophysical Research Abstracts
Vol. 18, EGU2016-11411, 2016
EGU General Assembly 2016

Comparing and Linking Post-fire Hillslope Erosion and Channel Change for Different Storm Types

Lee MacDonald (1), Stephanie Kampf (1), Dan Brogan (2), Sarah Schmeer (1), and Peter Nelson (2)

(1) Ecosystem Science and Sustainability, Colorado State University, Fort Collins, United States (lee.macdonald@colostate.edu), (2) Dept. of Civil and Environmental Engineering, Colorado State University, Fort Collins, CO

Moderate and high severity wildfires can greatly reduce infiltration rates, leading to orders of magnitude increases in hillslope-scale runoff and erosion rates. These increases can cause dramatic downstream channel change, with post-fire deposition being most common, but this depends on the number, magnitude and timing of storm events.

The objective of this study is to compare post-fire hillslope erosion rates and downstream channel change from two distinct rainfall events approximately one year after burning. The first was a set of relatively typical, higher-intensity convective storms in June-August 2013, and the second was a highly unusual, week-long ∼270 mm rainstorm in September 2013. The study was conducted in two ∼15 km2 watersheds that had two-thirds of their area burned at high or moderate severity by 2012 High Park Fire in northcentral Colorado, USA. Hillslope erosion was measured with sediment fences at 29 sites grouped into five clusters, with each cluster having an associated tipping bucket rain gage. Downstream channel change was monitored at approximately ten cross-sections in each of the two watersheds, Skin Gulch and Hill Gulch.

Twelve summer storms produced an overall mean hillslope erosion of 6 Mg ha-1, with higher rainfall intensities at lower elevations and in Skin Gulch causing higher sediment yields. The higher sediment yields in Skin Gulch caused substantial downstream deposition of up to 0.8 m at most cross-sections. Generally lower rainfall in Hill Gulch resulted in less Horton overland flow and hence lower erosion rates and much less downstream deposition. The September storm had roughly twice as much rainfall as the summer thunderstorms, but there were much lower peak rainfall intensities and hillslope-scale sediment yields except where shallow bedrock induced saturation overland flow. The much longer duration of the September storm resulted in sustained high flows, and these flows plus the lower hillslope erosion caused most of the cross-sections to incise rather than aggrade. Maximum mean bed incision was nearly one meter and some cross-sections also exhibited considerable lateral migration, removing much of the aggraded sediment from the previous two summer storm seasons. The results indicate that: 1) sediment yields are best correlated with the amount of precipitation above a given intensity threshold; 2) this threshold tends to increase over time with increasing surface cover; and 3) the standard trajectory of post-fire channel change can be completely altered by extreme storm events.