Streamflow and sediment yield following the 2000 Bobcat fire, Colorado Front Range

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Abstract. Wildfires are a concern in the Colorado Front Range because of the potential for increased runoff, erosion, and impacts to downstream resources. The purpose of this study was to characterize and compare the response of two watersheds in the 2000 Bobcat fire. One watershed had Burned Area Emergency Rehabilitation (BAER) treatments consisting of aerial seed, contour-felled logs, mulch, and straw wattles, and the other was only partially seeded. Water levels were continuously monitored and direct and indirect discharge measurements were used to develop streamflow rating curves. Suspended sediment samples were collected with automatic pumping samplers and grab samples. Sediment rating curves were used to estimate storm-specific suspended sediment yields.

Two months after the fire, a 25 year storm of 54 mm with a maximum 30-min intensity ($I_{30}$) of 42 mm hr$^{-1}$ generated a peak discharge of 3.9 m$^3$ sec$^{-1}$ km$^{-2}$ in the treated watershed. The same storm had minimal response in the untreated watershed due to the spatial variability of the rainfall. During the second summer, storms with maximum 30-min intensities of 23 and 32 mm hr$^{-1}$ generated peak discharges of 1.1 and 1.7 m$^3$ sec$^{-1}$ km$^{-2}$ in the treated and untreated watersheds, respectively. Maximum water yield efficiencies were 10 and 17 %, but most storms returned ≤ 2 % of rainfall as runoff. Maximum storm-specific sediment yields were 370 and 950 kg ha$^{-1}$ for the treated and untreated watersheds, respectively. $I_{30}$ explained > 86 % of the variability in peak discharges, > 73 % of the variability in storm runoff, and > 80 % of the variability in sediment yields.

The paired-watershed evaluation of the BAER treatments was inconclusive due to watershed differences, spatial variability in rainfall, and associated streamflow responses. The response in the treated watershed suggested that the treatments were ineffective during the high-intensity storms in the first two summers. Despite a minimal response in the third summer, hydrologic recovery was inconclusive due to below normal precipitation and vegetation regrowth.