Surface Armoring and Post-fire Recovery in the Colorado Front Range

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Abstract. High severity wildfires typically consume all of the surface organic matter and can induce a water repellent layer. These changes can increase runoff and erosion rates by several orders of magnitude. In the Colorado Front Range, runoff and erosion rates generally recover to pre-fire conditions within 3-4 years, and this recovery is attributed to increasing ground cover and decreasing soil water repellency. The goal of this study is to determine whether hillslope armoring also contributes to the observed decline in post-fire erosion rates over time.

Soil water repellency, percent ground cover, precipitation, and sediment production have been monitored on fourteen hillslope-scale erosion plots in the Hayman and Schoonover wildfires from 2002 to 2006. In 2006, the degree of armoring was determined by characterizing the surface and subsurface particle-size distributions for eight burned plots and six adjacent unburned plots. For the Hayman fire, the total rainfall erosivity was nearly identical in 2004 and 2006, but sediment production declined from the maximum value of 8.9 Mg ha^{-1} in 2004 to 1.5 Mg ha^{-1} in 2006. Over this same period there was little or no evidence of soil water repellency and the mean percent ground cover only increased from 49% to 61%. In the Schoonover fire, erosivity was 41% higher in 2006 than 2004, yet sediment production decreased from 10.9 Mg ha^{-1} to 2.5 Mg ha^{-1}. Although, percent ground cover increased from 25% to 48% in the burned plots, the 84^{th} percentile of the surface particle size distribution was nearly double the size of the subsurface material. In the unburned plots, there was no significant difference between surface and subsurface particle-size distributions indicating that significant armoring did occur after burning. Particle size analyses of the eroded sediment are being compared to the pre-burn soil particle-size distributions to determine whether the finer particles have been selectively eroded, and to assess how the particle-size distributions of the eroded material have changed over time.