Exploring Post-Wildfire Erosion using Terrestrial Lidar

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Abstract. Wildfires are major drivers of landscape change in the Rocky Mountains. Following a high-severity burn, erosion rates increase dramatically, imposing a perturbation on both ecological and anthropogenic systems that are not equilibrated to such high levels of erosion and sedimentation. Our ability to measure the amount of erosion on a landscape due to wildfire events has traditionally been limited to detailed surveys at discrete locations (e.g. channel cross-sections), and the integrated effect of the fire over a landscape was estimated using high maintenance field equipment such as sediment traps. We have recently tested a new method using terrestrial Lidar on a high severity burn section of the Four-mile canyon fire (~10 miles west of Boulder, CO) in order to track erosion on a hillslope scale and to determine the integrated erosion across the landscape by analyzing two digital surfaces of the real topography.

Using terrestrial Lidar, we have captured three unique states of a post-wildfire hillslope: 1) prior to any rainfall, 2) after the first rainfall, and 3) after a summer convective thunderstorm. The Fourmile canyon fire was fully contained on September 16, 2010. We were able to perform a Lidar scan on a section of high-severity burned hillslope approximately 3 weeks after the fire and prior to any rainfall. We obtained a second scan approximately 5 weeks after the fire and after the first small rain event which resulted in 15 mm of precipitation at a 2 mm/hr average intensity. A third scan was taken on July 15, 2011 after a few summer convective thunderstorms. Each of these scans represents a snapshot of the hillslope plot after unique forcing events and reveals the parts of the survey area that are susceptible to erosion.

We have compared the landscape surface of our study hillslope plot at different points in its recovery from a wildfire with the objectives of 1) understanding the role of different rainfall events on a high-severity burn, and 2) exploring the parts of a landscape that are most affected during hydrological erosional events. It appears that within six months of this fire most of the ash had been removed from the soil surface, and after a large summer rain event gravel and cobble sized particles were mobile on the hillslope. This method of analysis provides a detailed measure for the spatial analysis of hillslope erosion following a fire, while minimizing site disturbance.

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