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Post-fire Erosion by Wind and Cool-Season Runoff Processes in Sagebrush Steppe, Great Basin, USA

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Amplified erosion by water and wind following wildfires is a paramount concern on wildlands around the globe, but the interaction of hydrologic and aeolian erosion processes post-fire remains poorly understood. This study evaluated the impacts of fire removal of vegetation and ground cover on erosion in Great Basin, USA, sagebrush steppe (Artemisia spp.) with complex topography over a 2 yr period post-fire. The Great Basin sagebrush steppe domain is one of the most imperiled ecosystems in North America largely due to invasion by fire-prone annual grasses and an associated increase in wildfire activity. Most historical studies of fire impacts on erosion in sagebrush steppe applied plot-scale rainfall simulation methodologies to assess risk of erosion by water during high intensity rainfall events common during the hot summer season. Understanding of fire impacts on aeolian erosion processes for sagebrush steppe and elsewhere continues to advance, but remains limited for burned sagebrush landscapes with complex topography. The current study employed an array of silt fences at a burned sagebrush site to assess post-fire erosion by water during natural rainfall/runoff events throughout two years. The study design consisted of silt fence plots spanning average hillslope lengths of 11 m (short hillslopes) to 106 m (long hillslopes) along multiple slopes and 246 m (swales plots) in swales draining into an intermittent stream. In the immediate post-fire period, we observed extensive transfer of aeolian-entrained sediment to swales that contributed substantially to sediment supply within these areas. Erosion by water at all plot scales during the study was largely limited to cold-season rainfall events and snowmelt runoff and was greatest from swales where snow formed extensive drifts during the cold season. Snowmelt runoff flushed substantial sediment (as much as 1 t ha-1) from swales in each of two years following the fire and the amount of sediment was at least partially attributed to the aeolian deposits (ample sediment supply) in swales during the immediate post-fire period. The results provide quantitative post-fire erosion rates for sagebrush steppe associated with cool-season runoff events and complex topography and offer insight into the interaction of aeolian and water erosion processes for recently burned landscapes.