

Dynamics of post-wildfire wind erosion of soil in semiarid rangelands , Idaho , USA

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Introduction Post-wildfire soil erosion by wind is an important but unstudied ecological process in cold desert , semiarid shrub steppe . In particular , the post-fire dynamics of soil erodibility are not well understood . We examined threshold wind speed during saltation events as a measure of erodibility for three months following a late-summer wildfire in southeastern Idaho , USA rangelands during 2007 . Our objective was to describe variability and controls of erodibility throughout the first few months following fire , into the beginning of the winter period .

Materials and methods We measured the fraction of time saltation was detected (saltation activity) , the minimum wind speed required to initiate saltation (threshold) , air temperature (temperature) and percent relative humidity (rH) for five-minute intervals , and soil volumetric water content from 0-15 cm depth (water) for 6 hour intervals , at a burned and an unburned site . We determined and analyzed daily means of threshold , water , temperature and rH during saltation events at one burned site .

Results and discussion Little saltation activity was detected and threshold could not be assessed at the unburned site . Threshold increased during the course of the study at the burned site (Figure a) , suggesting that erodibility was highest immediately following fire and decreased throughout fall . Water , temperature , and rH (Figure b , c , d) were moderately-strongly correlated with threshold (Pearson's correlation = 0 .70 , -0 .68 , 0 .76 , respectively , all $p < 0 .00$) . A multiple regression model with rH and water as predictors explained substantial variability in threshold (threshold = $6 .92 + 0 .02 \text{ rH} + 0 .10 \text{ water}$, $r^2 = 0 .75$, p -values $< 0 .00$) .

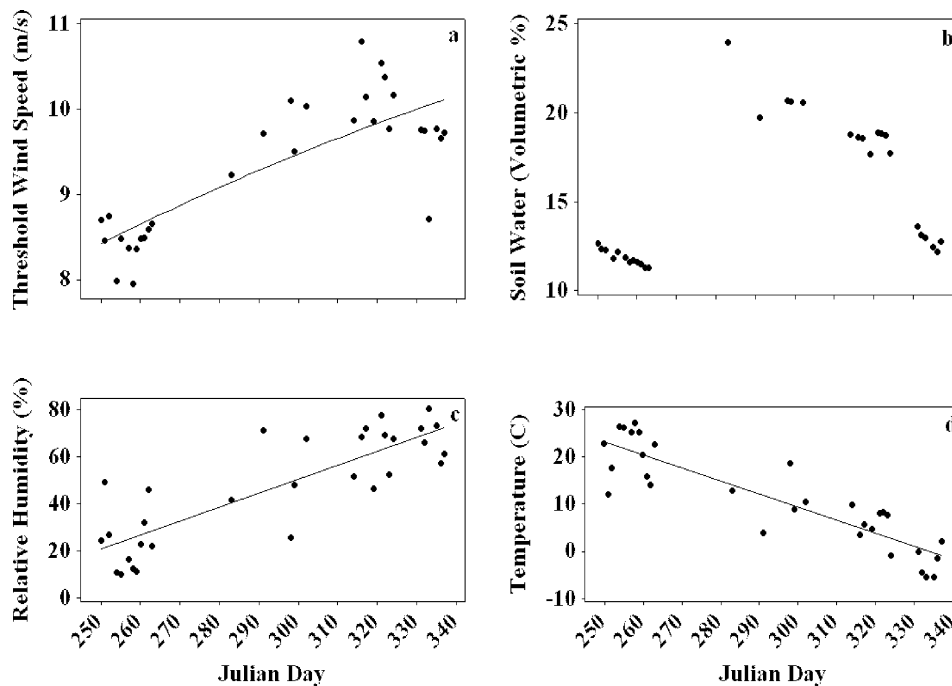


Figure 1 Daily mean threshold , soil water content , rH , and air temperature for erosion events occurring after summer wildfire .

Conclusions Preliminary findings from this study suggest that wildfire has the potential to increase wind erosion susceptibility in the semiarid rangeland environment we studied .Erodibility , as measured by daily mean threshold wind speed , appeared to be highest in the weeks immediately following fire .Both subsurface hydrology and boundary layer atmospheric conditions appear to be major controls on the dynamics of post-wildfire wind erosion .