Geophysical Research Abstracts, Vol. 9, 10211, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-10211

Predicting post-fire sediment yields: accuracy and limitations

L. MacDonald, I. Larsen

Department of Forest, Rangeland and Watershed Stewardship, Colorado State University, Fort Collins, CO 80523 (leemac@cnr.colostate.edu / Fax: 970-491-6307 Phone: 970-491-6109)

High severity wildfires can increase hillslope- and watershed-scale sediment yields by two or more orders of magnitude, and resource managers need to predict post-fire erosion rates on a spatially-explicit basis. Over the past six years we have measured annual and storm-based sediment yields from 95 hillslopes in 10 fires in the Colorado Front Range, yielding 400 plot-years of data. These data provide a unique opportunity to develop and test a variety of empirical, conceptual, and physically-based erosion models, and for assessing the variability in post-fire erosion rates over space and time. The objectives of this study are to evaluate the ability of RUSLE and Disturbed WEPP to predict post-fire sediment yields, and to more generally identify model limitations and improvements.

Both RUSLE and WEPP poorly predicted annual post-fire sediment yields, as the R^2 values ranged from 0.16 to 0.26. Both models were much better able to predict mean sediment yields for plots grouped by burn severity or fire (R^2=0.53-0.60), but the measured variability within each group was about twice the predicted variability. Both models tended to overpredict low erosion rates and underpredict the higher values, and in the case of RUSLE this tendency is due to the linear model structure. Detailed field measurements show that rilling, soil water repellency, and micro-topography are important controls on post-fire sediment yields, but neither model directly simulates these components, particularly on a spatially explicit basis. The Disturbed WEPP model also assumes a more rapid decline in post-fire sediment yields than we observed in the field.

In summary, the accuracy of current models is limited by their inability to represent all of the factors affecting post-fire sediment yields as well as our inability to adequately

characterize each of these factors in the field. Model improvements can only address the former, and the limited ability to address the latter suggest that models will always better predict average conditions than the behaviour of individual sites.