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Quantifying and predicting rill erosion after fire on steep shrub-dominated hillslopes

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The risk of significant erosion from most undisturbed sagebrush rangeland is low due to abundant canopy and ground cover. After disturbance by fire canopy and ground cover can be significantly reduced and the risk of hillslope erosion increases. In particular, rill erosion on steep slopes can dramatically increase and remain high until ground cover conditions recover. The Water Erosion Prediction Project (WEPP) model, developed to estimate erosion on cropland and rangeland, is a likely tool for addressing erosion risk questions following fire. WEPP individually models both interrill and rill erosion processes. Field experimentation used to develop the rangeland components of WEPP only included plots with slopes less than 15% with little evidence of significant rill erosion. Model optimization methodology was used with these data to derive regression-based parameterization procedures for critical shear and rill erodibility parameters. Experimental results from steep (20 to 40%) sagebrush rangelands suggest that the potential for rill erosion is significant for several years following fire and that WEPP underestimates rill erosion under burned conditions. Enhancements in WEPP relative to the rill erosion process are needed to improve estimates of erosion risk following fire. Comparison of model estimates with field data from burned sagebrush rangelands showed that WEPP rill detachment estimates can be improved by using enhanced estimates of rill erodibility. However, enhancements in algorithms related to the hydraulics of overland flow are also needed. Parameterization procedures for the Darcy-Weisbach roughness coefficients, rill width and rill spacing are all candidates for improvement.