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Sediment availability on burnt hillslopes

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In general, erosion has been modeled as being proportional to some form of energy or force (such as shear stress or stream power) with the proportionality constant being erodibility, which is a characterization of sediment availability. It is unclear if erodibility is constant with depth on recently burnt hillslopes. This study used both field- and laboratory based experiments to quantify sediment availability as a depth-dependent parameter on burnt hillslopes. An explicit representation of fire-effect on sediment availability was achieved by assuming that fire-effects produce a non-cohesive soil layer of variable depth. This depth is characterized as a probability density function with a single parameter that changed during recovery (0-3 years) as the available soil was depleted. Measurements in southeastern Australia found that initially after a wildfire the hillslope had a layer (0.75-0.91 cm in depth) of non-cohesive soil, which represented 97-117 t/ha of transport limited sediment. The thickness of this layer decreased exponentially with time since the wildfire. Additional results showed that fine roots (< 2-mm diameter) reduce the erodibility of surface soils for depths < 2 cm. The soil depth and root density accounted for $\sim$60 % of variation in the erodibility at soil depths < 2 cm. At greater depths the root effect diminished and other soil properties (% silt and clay in particular) became more important as predictors of erodibility. The results are organized into a conceptual framework for modeling fire-effects on sediment availability for systems with low and high pre-fire erodibility. The fire-effect produces an equal depth of non-cohesive soil for both systems but this represents a greater perturbation for systems with low pre-fire erodibility than for those systems with a high pre-fire erodibility.