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Finding spatial proxies for post fire erosion risk across diverse soilscapes

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Post fire erosion responses vary from negligible to extreme, however, despite some progress, the capacity to predict these remarkably variable responses across diverse landscapes remains a challenge. A key limitation is that the critical post fire soil properties that control runoff production and sediment and contaminant availability can't be mapped across the landscape. We currently lack pragmatic, spatial proxies for these critical soil properties that are essential for the parameterization of runoff and erosion models in the vast, inaccessible and heterogeneous mountainous terrain characteristic of burned landscapes. However, some recent successes are encouraging; Chafer et al., (2016), developed a model for mapping ash loads based on a function similar to the DNBR; Moody et al., (2015) report a model for post-burn infiltration based on remotely sensed burn severity, and Noske et al., (2016) and Sheridan et al., (2015) describe a model to estimate the post-fire infiltration properties of different soils based on Budyko's radiative index of dryness (aridity). In this last case, it seems that aridity acts as a proxy for soil macroporosity, a soil property that can limit the runoff generation potential of these water repellent soils. However, more recent measurements from a wildfire-burned coastal forest in south west Victoria, Australia, shows a different relationship between aridity and post fire runoff. While the mechanisms for this are not yet clear, it seems that the maritime influence (lower temperature in summer, higher relative humidity, reduced VPD) results in a different relationship between aridity and the soil properties that control post fire runoff generation in this coastal mountain range. An alternative proxy to aridity, the long-term average greenness based on Landsat imagery, shows a consistent relationship with the post fire runoff from both the inland and the coastal burned areas, suggesting proxies more strongly correlated with biological productivity may be more successful for mapping post fire runoff potential across a broader range of climatic conditions. The development of more universal proxies for critical post fire soil properties offers the potential to vastly improve post fire erosion prediction across diverse soilscapes.

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