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Perceived vs actual rates of soil erosion and redistribution following fire: an unsolved issue?

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Studies aiming to quantify rates of soil erosion and redistribution following wildfires have often reported large, and in some cases disastrous, soil loss rates during the first significant rainstorms following burning or under simulated rainstorms. These rates, however, have often been extrapolated from data derived at relatively small scales. The few studies conducted at hillslope and catchment scales have indicated that, viewed at large scales, significant quantities of the mobilised sediment often undergo redistribution on hillslopes and in channels and may not be exported from catchments. Here we aim to evaluate published results of measurements of soil losses at different scales and note that, as would be expected, there is a generally negative relationship between size of the area of measurement and soil erosion rate. Despite much endeavour, we have comparatively little reliable data on of post-fire soil losses at larger scales. More importantly, perhaps, there seems to be a relatively poor understanding the medium- to long-term soil degradational significance of post-fire soil losses. This is not helped by the reliance on short-term measurements of elevated small scale losses and direct comparison with measurements from long-unburnt forests rather than with some assessment of soil loss tolerance for disturbed forests. We consider the following advances as particularly effective in allowing a better quantitative and qualitative evaluation of fire impacts on soil erosion and redistribution in the future. (i) The establishment of soil renewal rates for common fire-prone environments under natural conditions over long timescales. This would allow development of environment specific tolerable soil loss rate as currently used for erosion from agricultural land. (ii) As conventional soil erosion monitoring methods are difficult to apply to large scales, the wider application of sediment source tracing and cosmogenic radionuclide techniques to post-fire terrain could help to complement our knowledge of small-scale erosion processes by

providing potentially a catchment-wide overview of soil redistribution over diurnal to decadal timescales. (iii) Published erosion rates have been expressed in different units, leading to errors and misunderstandings. A standardised way of expressing soil loss should be adopted internationally. (iv) In addition to soil erosion by water, a more comprehensive consideration should be given to the relative contributions of processes such as landslides, debris flows and wind transport.