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Nitrogen and phosphorus exports and processes from burnt eucalypt forests

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Little is known about the biogeochemical responses of catchments to wildfire. In particular, the processes of nutrient generation, the temporal signature of constituent form, and consequent magnitude and time series of nutrient stream loadings are poorly characterised. Following a wildfire in south eastern Australia that burnt over 1 million hectares of forested land in early 2003, two former research catchments (136 and 244 ha) in the East Kiewa valley, Victoria, were re-instrumented. Discharge, suspended sediment, bedload and nitrogen (N) and phosphorus (P) were measured for three years post-fire. The nutrient data consisted of 15-minute estimation of particulate P and Total Kjeldahl N concentrations via a regression with turbidity, and concentrations of dissolved forms of P and N estimated from over 1100 water samples. The fire appears to have increased total P and N exports by around 5-6 fold, peaking at 1.6 kg ha-1 of P and 15.3 kg ha-1 of total combined N. Nutrients transported as particulate matter dominated the first post-fire year, with 94% of total combined P and 69% of total combined N. Although dissolved forms increased in importance over time, the particulate load comprised 86% of the total combined P load and 68% of the total combined N load over the three post-fire years. This suggests the dynamics of overland flow generation and erosion processes are the critical drivers of constituent production in these landscapes following fire. Concentrations and loads of P and N exhibited a rapid recovery to unburnt levels during the second post-fire year. Particulate forms declined sharply through a reduction in sediment delivery. Nitrate displayed the slowest relaxation time, suggesting a persistent subsurface pathway and the effect of nitrification. Notably, dissolved N fluxes were predominantly transported in baseflow even in the first post-fire year. A simple model with time as the single parameter proved to be a good predictor of mean three monthly concentrations. Phosphorus enrichment ratios from point to plot were 2 and from plot to catchment were 1.5, indicating the effect of particle size selection on particulate P transport was relatively low.