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Modelling the response of surface fuel to climate change across south-eastern Australia: consequences for future fire regimes .

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Changes to fire regimes in the future will be determined by a complex range of processes. Vegetation, weather and ignitions may be altered by climate change, elevated CO_2 and human activity. In this study, we used an empirically based approach to project future changes in surface litter fuel within major vegetation formations (rainforest, wet sclerophyll forest, dry sclerophyll forest, grassy woodlands) the temperate and subtropical areas of south eastern Australia.

Climatic controls of litterfall, decomposition and steady state fuel load within each vegetation formation were examined using metadata derived from field studies. Changes in steady state litter fuel load were then estimated for the current spatial domain of each vegetation formation (1 km grid), using the fuel/climate models, and a range of 2080 climate projections (5 GCMs) selected to encompass both warmer and drier and warmer and wetter future conditions for the region, under the A1b emissions scenario.

Steady state surface fine fuel load was generally, negatively related to mean annual temperature but mean annual rainfall had divergent effects dependent on vegetation type. Under all 2080 climate projections, a mean decline in steady state surface litter was predicted in dry sclerophyll forest (-5 to -18%), the most extensive forest type in the region. Similarly a general decline was estimated for rainforest (-5 to -13%). For the other vegetation formations, predicted 2080 responses varied from a small mean increase to a more substantial decline: i.e. + 0.1 to – 24%, grassy woodlands; +3 to -18%, wet sclerophyll forest.

The predominant, predicted decline in future surface fine fuel load has the potential to reduce future area burned due to the influence of fuel load on fire behaviour in these ecosystems. Early results from experiments and stand growth models dealing with Eucalyptus species indicate that possible declines in surface fine fuel load induced by a warmer climate may be partially off-set by elevated CO_2 effects on plant growth. We hypothesize, that the trajectory of change of fire during the 21st century across south eastern Australia may be non-linear: i.e. an initial increase in fire driven by increasing severity of fire weather followed by a decline due to declining fuel loads.