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Will elevated CO_2 alter fuel characteristics and flammability of eucalypt woodlands?

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Rising atmospheric CO_2 may enhance forest productivity via CO_2 fertilisation and increased soil moisture associated with water savings, potentially resulting in increased woody plant abundance i.e. woody thickening. Changes to vegetation structure via woody thickening, as well as changes to vegetation properties (e.g. leaf characteristics and moisture content), may have important implications for ecosystem flammability and fire regimes. Understanding how elevated CO_2 alters flammability and fire regimes will have implications for ecosystem dynamics, particularly carbon sequestration and emissions. We present data from Free Air CO_2 Enrichment (EucFACE) and whole tree growth chamber (WTC) experiments to assess the effect of elevated CO_2 on fuel properties and flammability of eucalypt woodlands. Experiments involved ambient (~400 ppm) and elevated CO_2treatments, with elevated treatments being +150 ppm and +240 ppm at EucFACE and the WTCs respectively. We examined the response of vegetation parameters known to influence ecosystem flammability, namely (i) understorey vegetation characteristics (ii) understorey fuel moisture and (iii) leaf flammability.

Understorey growth experiments at EucFACE using seedlings of two common woody species (*Hakea sericia*, *Eucalyptus tereticornis*) indicate that elevated CO_2 did not influence stem and leaf biomass, height or crown dimensions of seedlings after 12 months exposure to experimental treatments. Temporal changes to understorey live fuel moisture were assessed at EucFACE over an 18 month period using time lapse cameras. Understorey vegetation greenness was measured daily from digital photos using the green chromatic coordinate (GCC), an index that is highly correlated with live fuel moisture (R^2 = 0.90). GCC and rates of greening and browning were not affected by elevated CO_2, though they were highly responsive to soil moisture availability and temperature. This suggests that there is limited potential for elevated CO_2 to alter flammability due to changes in understorey fuel biomass and structure or fuel moisture.

Leaves of *Eucalyptus globulus* and *E. saligna* grown under elevated CO_2 in whole tree growth chambers tended to be thicker than those grown under ambient CO_2. Ignition delay time was significantly increased in elevated CO_2grown leaves, while total heat output and mass loss were also reduced though effects were contingent on temperature and water availability effects. Complementary work on the flammability of eucalypt leaves collected from the EucFACE experiment treatments (elevated CO_2 and ambient) will be discussed. These initial investigations therefore indicate some potential for elevated CO_2 to reduce aspects of flammability of litter fuels in Australian forests and woodlands.