GREENHOUSE GAS EMISSIONS FROM FIRE AND THEIR ENVIRONMENTAL EFFECT

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INTRODUCTION

Fire directly impacts the carbon balance of forests through emissions of carbon dioxide (CO_2), carbon monoxide (CO), non-methane hydrocarbons (NMHC) and other greenhouse gases and particles formed during combustion of vegetation and litter.

In this study, we determine the apportionment of carbon to different combustion products from prescribed burns of *Eucalyptus* lowland forest and compare these data to other studies on Australia ecosystems. We then examine the effect this apportionment has on estimates of fire emissions from these E*ucalyptus* lowland forest sites in comparison to those using the methodology in the Australian National Greenhouse Accounts National Inventory Report (AUS NIR; 2011).

METHODS

Four study sites were located in the East Gippsland region of Victoria, near Orbost. Estimates of biomass loadings for coarse woody debris, twigs, leaf litter, surface layer live fuels, shrubs, trees and decomposing material were made before and after prescribed fire.

Samples of each fuel fraction from each site were combusted in a mass loss calorimeter. Measurements of the CO_2 and CO emitted were made using infra-red gas analysers.

The carbon content of the fuel fractions and ash in the calorimeter experiment and that of the biomass of the four sites was measured by elemental analysis.

Estimates of the total fire emissions from the sites, expressed in CO_2 equivalents (CO_2-e), was made using the methodology in the AUS NIR (2011) with the data collected in this study and the study's default values.

RESULTS

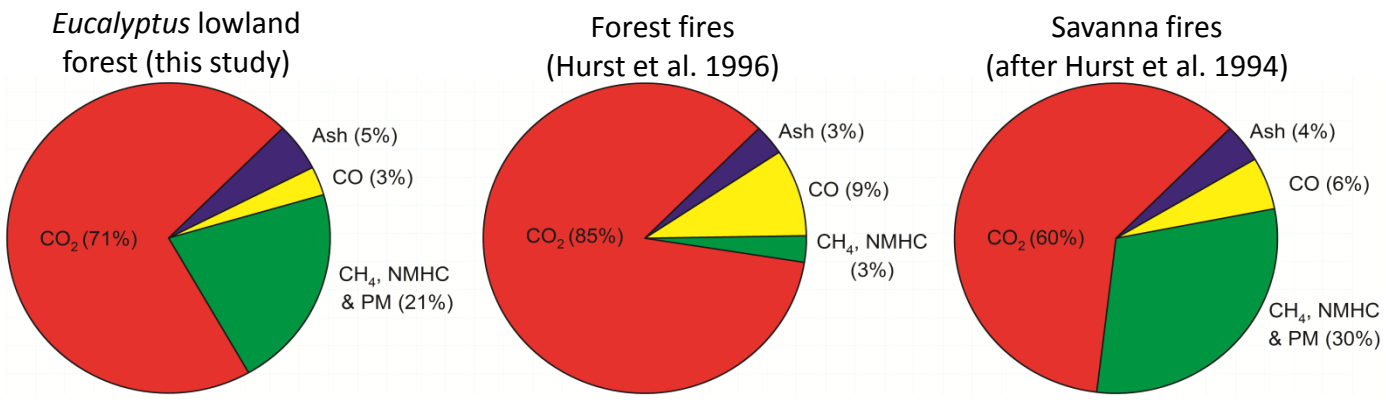

Figure 1: Fuel carbon partitioning in three different vegetation types. CO_2 = carbon dioxide, CO = carbon monoxide, CH_4 = methane, NMHC = non-methane hydrocarbons and PM = particulate matter carbon.

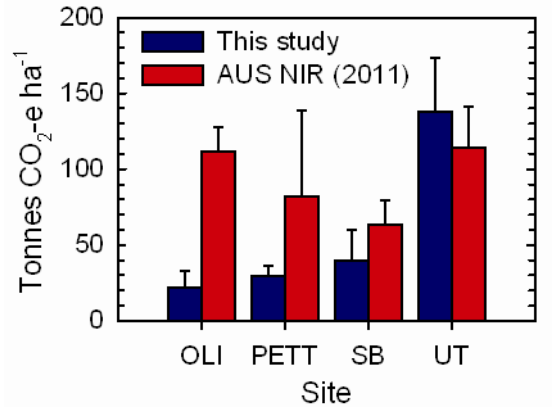

Figure 2: Fire emissions from four *Eucalyptus* lowland forest sites. Emissions were calculated using the methodology in the AUS NIR (2011) with the data collected in this study and the AUS NIR (2011) default values. Site codes: Oli = Oliver Road, PETT = Pettman's Road, SB = South Boundary Road and UT = Upper Tambo Road.

Fuel carbon partitioning:
Figure 1 shows the partitioning of carbon in fuel from a *Eucalyptus* lowland forest compared to forest fires from the Sydney region and those from Australian savannas.

In all cases, the majority of carbon lost during combustion as is CO_2.

The partitioning of carbon loss from lowland *Eucalyptus* forests is not the same as from the other locations.

Fire emissions:
Figure 2 shows that the total fire emissions from the four *Eucalyptus* lowland forest sites were highly variable.

Calculations of total fire emissions using the default values from the Australian National Inventory Report over-predict emissions from three of the four study sites.

The differences were caused by overestimation of the amount of biomass consumed in the Australian National Inventory default values.

CONCLUSION

The total amount of carbon lost to the atmosphere from *Eucalyptus* lowland sites, because of fire, is similar to other vegetation types but the exact composition of the carbon loss is not.

Use of default values in the Australian National Inventory Report (2011) to calculate carbon loss from fires can lead to significant errors for vegetation classes not characterised by the report.

END USER STATEMENT

Estimating carbon emissions from bushfire is a difficult task. Research such as the greenhouse gas emissions from fire and their environmental effects project will enable land managers to strengthen reporting on greenhouse gas emissions from wildfire. Data from the CRC will enable land managers to improve their estimates of wildfire emissions. Additionally, science such as this will be of great value to those developing and applying national carbon accounting models to better include the effects of wildfire. Martin Moroni, Manager, Sustainability Branch, Forestry Tasmania.

References: Australian National Greenhouse Accounts National Inventory Report (2011) DIICCSRTE (Canberra). Hurst DF et al. (1994) *JGR-Atmospheres, 99, 16441-16456.* Hurst DF et al. (1996) Trace gas emission from biomass burning in Australia. In 'Biomass Burning and Global Change' (Ed JS Levine) pp. 787-794. (The MIT Press, Cambridge, Massachusetts).

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