Forest Carbon Balance and Emission Management

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Background and Study Objectives

Regular fuel reduction burning or planned fire is essential to reduce the risk of bushfires in forests near population centres and important assets such as water catchments. Impact of planned and bushfire on forest carbon and released emissions remains unclear.

In this project we seek to answer the following questions:

- What forest carbon pools are most affected by fire?
- What is the magnitude of emissions produced by planned fire and bushfire?
- How burn techniques can minimise carbon losses and emissions during planned fires?
- What is the rate of forest carbon recovery after fire over a range of timescales?

Study sites and measuring techniques

- Field based study, dry sclerophyll forest, low to mid elevation; long unburnt (Tab. 1)
- Sites along south-eastern Australia (Fig. 1, Tab 1).

- For forest carbon measurements, forest divided into 4 carbon pools:

1) Aboveground alive (live overstorey trees, understorey vegetation, elevated fuels);
2) Deadwood (stump, dead standing trees, coarse woody debris);
3) Litter (dead leaves, bark, twigs and branches with d<2.5 cm);
4) Soil (inc. soil organic matter, soil 0-30 cm)

- Standard inventory techniques are used to estimate biomass in each carbon pool before and immediately after fire. Based on biomass difference, carbon losses and emission released are estimated

Table 1. Study sites general information and forest characteristics

Site Location	Agency	# plots	Overstorey, d>20 cm			Years since fire	Mean annual rainfall, mm
			Dominant Species	Av. diameter, cm	Av. height, m		
VIC, Otways	DSE	9 (all burnt)	*E. obliqua; E. radiata*	44.0	23.7	26-28	>1000
VIC, Gippsland	DSE	9 (burns postponed)	*E. sieberi; E. obliqua*	46.7	26.0	13-19	>900
TAS, St Helen, Coles Bay	Tas. Parks and Wildlife Service	8 (4 burnt)	*E. amygdalina; E. obliqua;*	34.4	10.1	>22	>600
QND, Gympie	Qld Parks and Wildlife Service	6 (planned for burn July 12)	*E. acmenoides; Corymbia maculata*	35.9	25.1	15-20	>1100
NSW, Eden	Forests NSW	Planned					>800

Preliminary results

- Overstorey trees were major carbon pool (Fig 2);
- Planned fire significantly reduced litter and elevated fuels (60%-100% of pre-burnt values);
- Planned fire had no effect on overstorey or deadwood;
- CO_2 accounted for >90% of all emissions produced during planned fire;
- CO_2 and non-CO_2 emission were correlated with fire intensity (Fig. 3);

Fig. 1. Study sites locations, each pin represents 3 plots

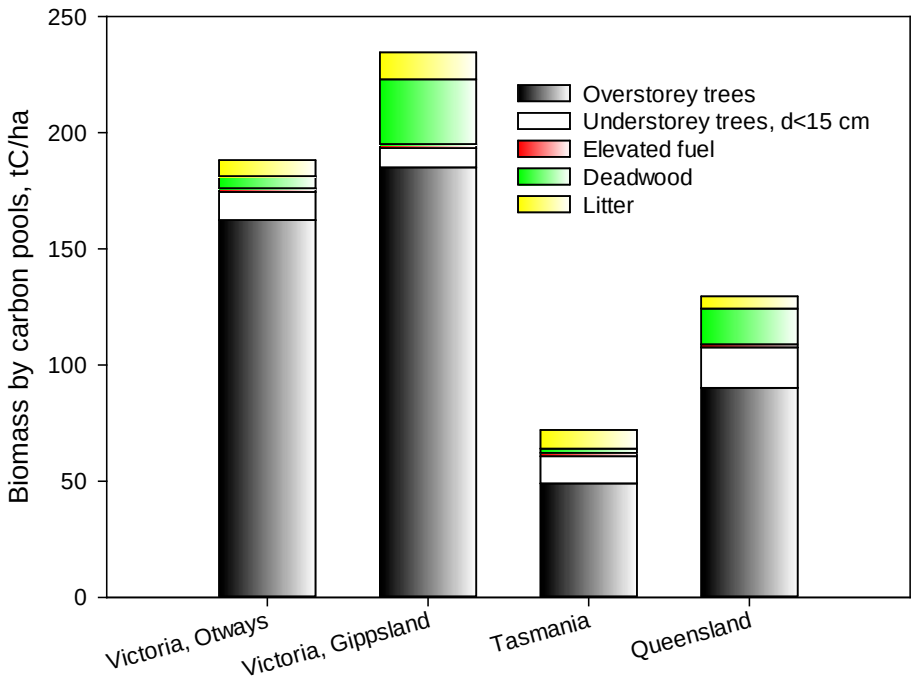

Fig. 2. Carbon biomass by pools at four study locations

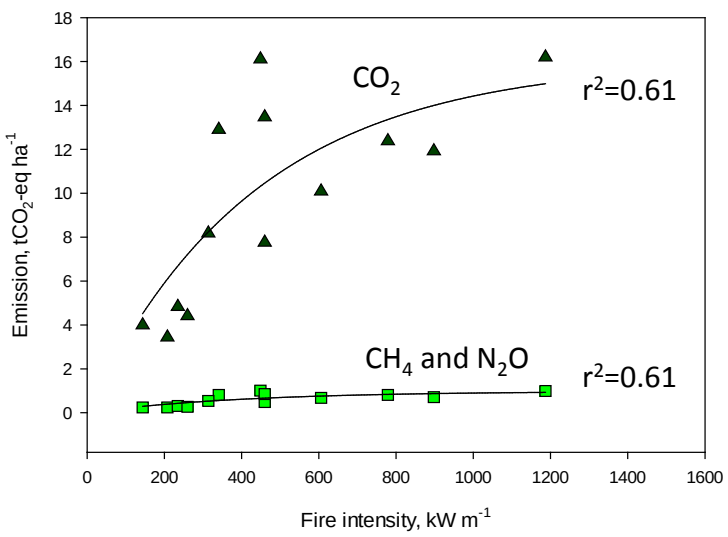

Fig. 3. Emission produced during planned fire in Otways and Tasmania. Dark triangles represent carbon dioxide (CO_2) and green squares are methane (CH_4) and nitrous oxide (N_2O). Emission calculations are based on litter loads only

Victoria, Otways

Victoria, Gippsland

Tasmania

Queensland