Submission No 10

INQUIRY INTO WAMBELONG FIRE

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Some observations on the effectiveness

of fuel reduction burning in

Southern Australia

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Introduction

The recent Royal Commission into the fires of 7 Feb 2009[2] which in terms of life loss was the worst natural disaster in Australia recommended a fuel reduction program that amounted to 5 % of publically owned land in Victoria. A crucial question is what can be expected in terms of decreased loss of life and damage as a result of such a fuel management strategy? What would be the effect of prescribed burning levels other than 5%, perhaps 10% and 15%? This note is an attempt to provide some guidance to this crucial question.

Methodology

An examination of life loss in disaster fires in southern Australia and modelled and actual relationships between prescribed burning and subsequent bushfire area burnt has offered the opportunity to estimate the efficacy of prescribed burning as a protective strategy.

It is assumed that a decrease in fire intensity and fire area will result in a decrease in casualties and asset damage. A correlation between average Byram Fire Intensity (mega watts per meter) will be sought for disaster and extreme fires that involve both rural and urban environments. The average fuel levels for different fuel reduction regimes will be estimated and the life loss – fire intensity equation used to compare expected life loss for extreme or catastrophic fire for 5, 10 and 15% annual prescription burning

A different strategy will be the use of actual[3] and modelled [4] annual average area burnt by wildfire as a function of fuel reduction.

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[1] School of Geography and Environmental Science, Monash University, Clayton, Victoria, Australia.

[2] B.Teague, R.McLeod and S. Pascoe, July 2009. *Victorian Bushfires Royal Commission,* Government Printer for the State of Victoria.

[3] Sneeuwjagt (2008) *Prescribed burning: How effective is it in the control of large bushfires? In Fire, Environment and society*: From Research to Practice, Bushfire CRC; The Australasian Fire and Emergency Authorities Council, Adelaide, SA, 99 419-435.

[4] King, Cary, Bradstock,Chapman, Pyrke, Marsden-Smedley (2006) *5*. Int. J. Wildland Fire 15, 527-540

Life loss as function of Byram fire intensity index.

In this analysis the forecast or recorded fire weather conditions and estimates of fuel have been correlated with the loss of life for notable disaster fires that have impinged upon populated areas. That correlation produces a simple linear equation that allows prediction of life loss for the same fire weather but reduced fuel as a result of chosen fuel reduction fire frequency.

Table 1. Gives a FFDI for six disaster fires in South East Australia with the concurrent loss of life. A simple linear equation is fitted.

Fire event	Peak FFDI	Estimated Byram Fire Intensity Index, Megawatts per metre[5]	Lives lost
Black Friday 1939	100	29[6]	71[7]
Victoria 1944	110	41	49[4]
Hobart 1967	78	42	62[4]
Ash Wednesday Victoria 1983	191	72	73
ACT 18 Jan 2003	105[8]	47	4
Black Saturday, Victoria, 2009	164	89	173

The selected fires give a relationship between the Fire Intensity and Lives lost as

Lives lost = 0.66 X Fire intensity (mega watts per metre)– 11 r=.52

The simple equation has been applied to bushfires but burning in landscapes that have had different fuel reduction burning frequencies. The nominal Forest Fire Danger Index (FFDI)[9]of 100 is chosen as it represents the upper limit of extreme fire weather and an index that can be expected a few times per decade.

Table 2. Gives the estimated fine fuel levels and estimated life loss for a FFDI of 100 with five fuel reduction regimes.

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[5] Using average Bureau of Meteorology station measured or forecast winds.
[6] Fuel estimate from Walker in Gill,Fire and the Australian Biota, Australian Academy of Science Canberra, 1981. Page121.
[7] Luke and McArthur. *Bushfires in Australia*, Australian Government Publishing Service, Canberra, 1978. Page 308.
[8] Gellie,N., in *A Nation Charred: Inquiry into the recent Australian Bushfires,* House of Representatives Select Committee on the Recent Australian Bushfires, the parliament of Australia, Canberra, October, 2003. Appendix E page 11 Fig5.
[9] The McArthur FFDI is an empirical index that was designed to provide guidance to the difficulty of suppression and aid fire weather forecasting. It is the standard method for determining fire weather warnings. See Noble I, Barry G, Gill A (1980) *McArthur's fire danger meters expressed as equations.* Australian Journal of Ecology 5, 201–203. doi:10.1111/J.1442-9993.1980.TB01243.X

Fuel reduction burning regime percent per annum	Estimated average fine fuel levels, tonnes per hectare [10]	Estimated Byram Fire Intensity Index for a FFDI of 100. Megawatt per metre	Expected life loss using above equation
0	35	63	31 (100%)
1.6	35	63	31 (100%)
5	23	32	10 (32%)
8	20	23	4 (13%)
10	17.5	18	1 (3%)
15	12	8.6	0 (0%)

Estimating life loss by bushfire area.

There are two satisfactory sources of information about the relationship between annual fuel reduction burning and subsequent bushfire area loss. The first is a modelling study for heath lands in SW Tasmania[4] and the second is the actual result of 45 years of fuel reduction in the SW of Western Australia[3]. The two studies support each other nicely and it is as reassuring to have a modelling result validated by actual experience, as it is to have a theoretical underpinning for actual experience. The assumption is made that the losses are proportional to the area burnt.

Table 3 predicts the lives lost using Black Saturday as the benchmark using the modelled data from Tasmania.

Prescribed burning program	0% pa	5% pa	8% pa	10% pa	15% pa
Predicted bushfire loss	100%	66%	45	33%	20%
Expected life loss for the Black Saturday event	173	115	80	59	35

[10] Using the mountain gum fuel growth curves in Gellie.

Table 4. Predicts the life loss for a Black Saturday event but using the actual data from Western Australia.

Prescribed burning program	0% pa	5% pa	8% pa	10 % pa	15% pa
Predicted bushfire loss	100%	45%	27	19%	5%
Expected life loss for the Black Saturday event	173	78	48	33	9

The lower expected life loss for the actual West Australian data could be due to the effectiveness of fuel reduction at decreasing the fire intensity as well as the area burnt. In fact if the decrease in fire intensity is calculated for the resulting fuel levels then the actual and Tasmanian modelled expectations are much closer.

Discussion

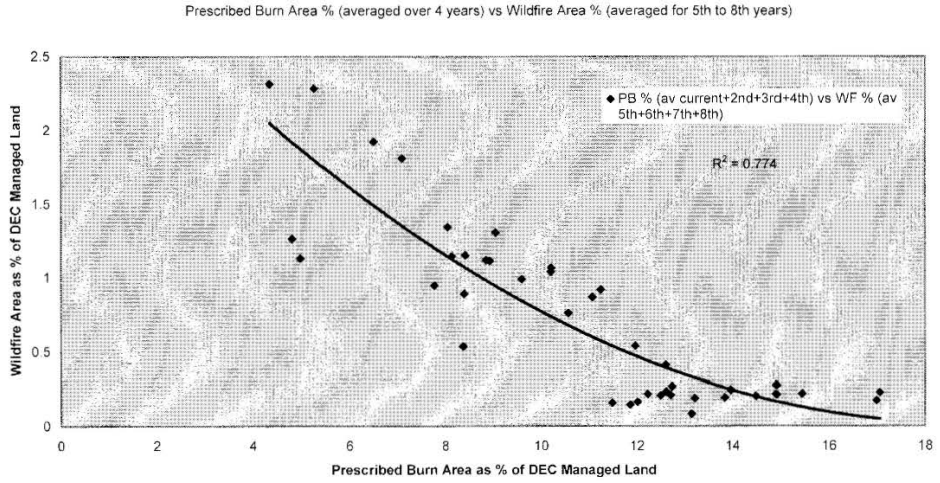
This note makes many assumptions which in future analysis should be validated or amended. The assumptions used in this analysis are that essentially all fires burn through the same populations and the relationship between Byram fire intensity and life loss is simple and thus the data for the life loss- intensity relationship should cover all fires and intensities.

Irrespective of the weakness of these assumptions this note gives an indication of the expected efficacy of fuel management by burning in protecting our communities against bushfire life loss.

It is safe to conclude that it is not until we undertake a 15% pa burning program that we could expect no life loss. The gain at 5%pa is small but by 8% pa it is becoming very much better. There is informed opinion amongst fire managers that 10 – 12% is the optimum for fire protection.[11] This analysis supports their hard won wisdom.

[11] E.g. McCaw, Gould and Cheney. *Quantifying the effectiveness of fuel management in modifying wildfire behaviour*. International Bushfire Research Conference 2008, Adelaide Convention Centre, 1-3 September

Figure 10: Prescribed Burn Area Percentage (average over 4 years) vs Wildfire Area Percentage (average for 4 years)



Short CV David Packham

David Packham OAM, MAppSci, has worked for 50 years in bushfire research in CSIRO, Monash University, The Australian Emergency Management Institute and in fire weather policy at the Bureau of Meteorology.

His extensive research (61 publications) has concentrated on the physics and chemistry of bushfires and he applied this research to practical issues including the development of aerial prescribed burning, non-evacuation of properties, modelling of fire behaviour and some forensic investigation of firefighter deaths.

He is currently an Adjunct Senior Research Fellow in the School of Geography and Environmental Sciences at Monash University, Clayton Campus.