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Supplementary Material

Incorporating burn heterogeneity with fuel load estimates may improve fire behaviour predictions in south-east Australian eucalypt forest

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Supplementary Material

Table S1. Summary of analyses of fine fuel loads with either a one-way ANOVA or, if data violated ANOVA assumptions, a Kruskal-Wallis test. Statistically significant *p*-values (<0.05) are in bold text.

Response variable	Forest type	*F*-value	Kruskal-Wallis chi-squared	*p*-value
Surface (litter and near surface combined)	Western slopes dry sclerophyll	21.3	NA	**<0.001**
	South east dry sclerophyll	30.6	NA	**<0.001**
	Sydney hinterland dry sclerophyll	184.9	NA	**<0.001**
	Southern tableland wet sclerophyll	477.7	NA	**<0.001**
Litter	Western slopes dry sclerophyll	27.3	NA	**<0.001**
	South east dry sclerophyll	31.8	NA	**<0.001**
	Sydney hinterland dry sclerophyll	124.2	NA	**<0.001**
	Southern tableland wet sclerophyll	56.5	NA	**<0.001**
Near surface	Western slopes dry sclerophyll	NA	6.6	**0.036**
	South east dry sclerophyll	NA	4.7	0.093
	Sydney hinterland dry sclerophyll	NA	6.1	**0.047**
	Southern tableland wet sclerophyll	NA	7.1	**0.029**
Elevated	Western slopes dry sclerophyll	NA	1.1	0.592
	South east dry sclerophyll	NA	0.8	0.674
	Sydney hinterland dry sclerophyll	NA	3.3	0.195
	Southern tableland wet sclerophyll	NA	2.1	0.352
Elevated, excluding post-fire regrowth	Western slopes dry sclerophyll	NA	5.8	0.055
	South east dry sclerophyll	NA	7.2	**0.028**
	Sydney hinterland dry sclerophyll	NA	7.1	**0.028**
	Southern tableland wet sclerophyll	NA	4.1	0.128
Bark	Western slopes dry sclerophyll	NA	7.8	**0.020**
	South east dry sclerophyll	NA	7.7	**0.021**
	Sydney hinterland dry sclerophyll	NA	11.0	**0.004**
	Southern tableland wet sclerophyll	NA	9.5	**0.009**

Table S2. Summary of analyses performed on fuel hazard scores one-year post-fire. Statistically significant *p*-values (<0.05) are in bold text. NA values represent comparisons where there was no variance in hazard scores, i.e. all values were the same for each fire severity class.

Response variable	Forest type	Kruskal-Wallis chi-squared	*p*-value
Litter	Western slopes dry sclerophyll	14.0	**<0.001**
	South east dry sclerophyll	10.8	**0.005**
	Sydney hinterland dry sclerophyll	10.8	**0.005**
	Southern tableland wet sclerophyll	10.7	**0.005**
Near surface	Western slopes dry sclerophyll	1.3	0.535
	South east dry sclerophyll	1.2	0.553
	Sydney hinterland dry sclerophyll	4.4	0.108
	Southern tableland wet sclerophyll	7.5	**0.023**
Elevated	Western slopes dry sclerophyll	6.7	**0.036**
	South east dry sclerophyll	2.5	0.282
	Sydney hinterland dry sclerophyll	5.7	0.057
	Southern tableland wet sclerophyll	NA	NA (all hazard scores were 'Low')
Bark	Western slopes dry sclerophyll	7.8	**0.020**
	South east dry sclerophyll	7.7	**0.021**
	Sydney hinterland dry sclerophyll	11.0	**0.004**
	Southern tableland wet sclerophyll	9.5	**0.009**

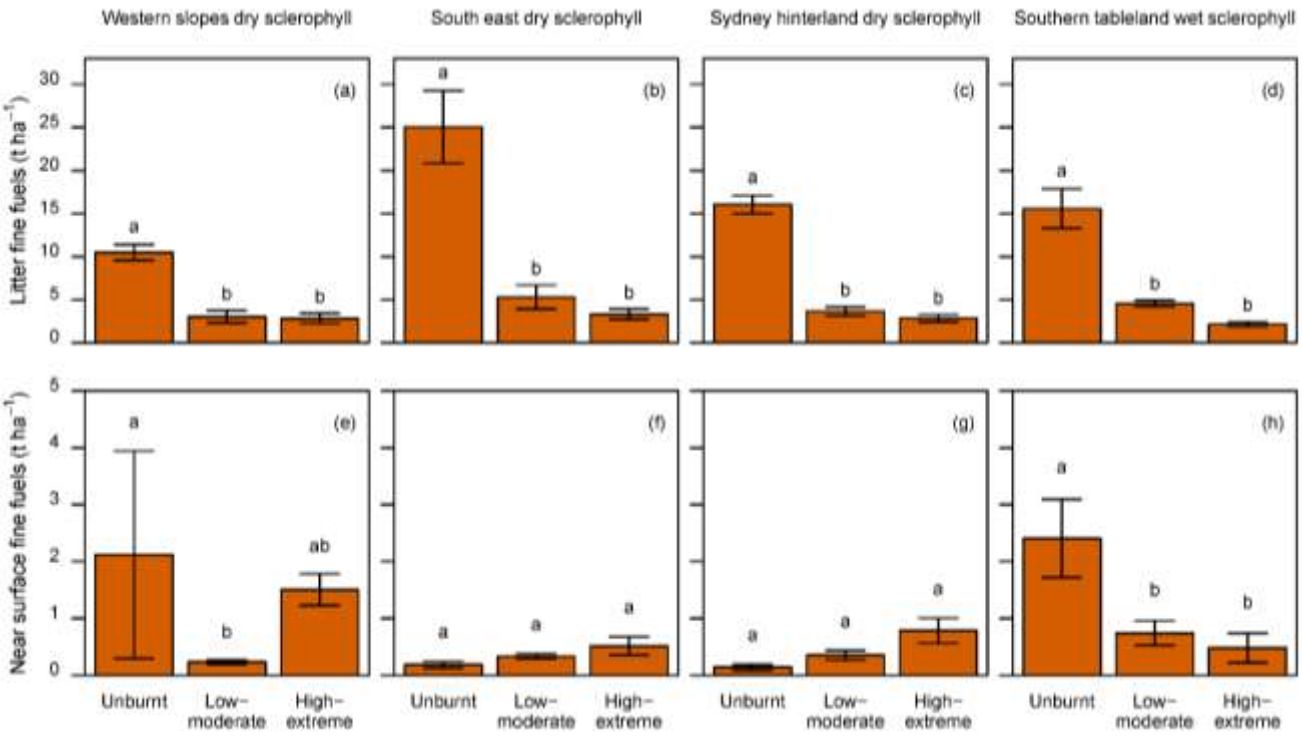

Fig. S1. Variation in fine fuel loads as a function of forest type and fire severity. Fine strata represented are (a) litter fuels and (b) near surface fuels. Data illustrated are averages ±1 S.E. Differing letters above bars indicate significant differences among fire severity classes (p<0.05).

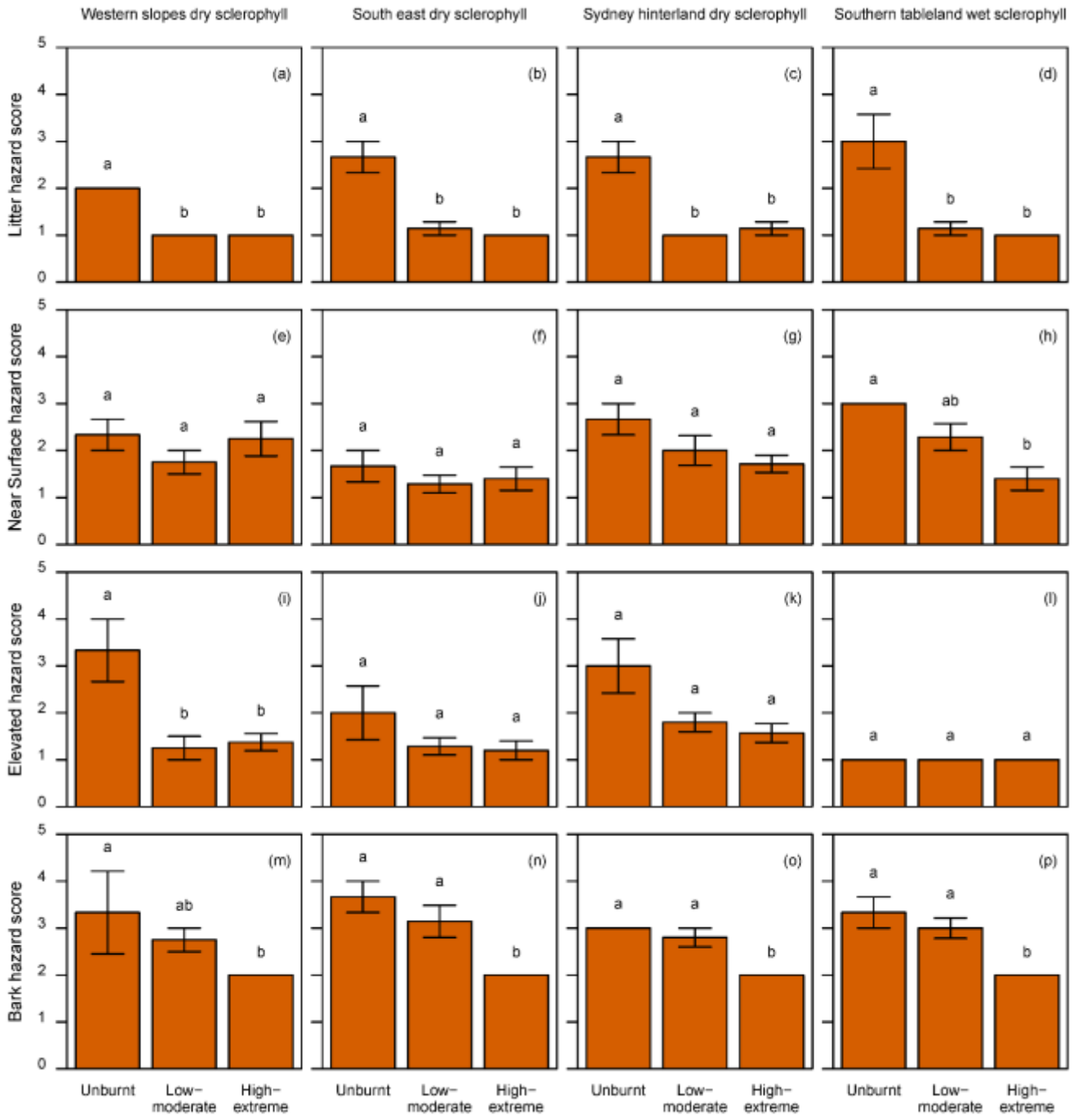

Fig. S2. Variation in fuel hazard scores as a function of fire severity for each forest type. Fuel strata represented are (a) litter fuels, (b) near surface fuels, (c) elevated fuels and (d) bark fuels. Data illustrated are averages ±1 S.E. Differing letters above bars indicate significant differences between among fire severity classes (p<0.05). Fuel hazard scores range from 'low' to 'extreme' and were converted into numerical values ranging from 1-5.

Table S3. Fuel accumulation curve parameters for equation 1. Presented are parameters for current curves used for operational fire management in NSW (Watson, 2012), and parameters derived from our field observations. We did not modify "*k*" values, *k* is a constant related to decomposition. Note, where we did not observe a significant effect of fire severity on post-fire fuel loads, we pooled observations across fire severity classes to estimate the initial fuel load. Where we observed no significant effect of fire on fuel loads, we did not model fuel accumulation, instead assuming fuels remained at steady-state conditions.

Fuel strata	Current "original" curves			Modified curves			
	r + c	*c*	*k*	*r + c*	*c*	*c*	*c*
					Fire-severity pooled	*Low-moderate fire severity*	*High-extreme fire severity*
Surface							
Western slopes dry sclerophyll	12.50	1.00	0.16	12.61	2.48	NA	NA
South east dry sclerophyll	12.00	1.00	0.19	25.24	0.62	NA	NA
Sydney hinterland dry sclerophyll	16.40	1.70	0.17	16.19	1.49	NA	NA
Southern tableland wet sclerophyll	18.00	1.00	0.35	17.98	NA	-0.04	-3.81
Elevated							
Western slopes dry sclerophyll	2.50	0.30	0.15	0.98	NA - Assume no change post-fire	NA	NA
South east dry sclerophyll	5.00	0.70	0.19	1.52	0.08	NA	NA
Sydney hinterland dry sclerophyll	4.90	0.70	0.20	1.00	0.24	NA	NA
Southern tableland wet sclerophyll	2.00	0.10	0.15	0.12	NA - Assume no change post-fire	NA	NA
Bark							

Western slopes dry sclerophyll	2.0	1.00	0.10	3.33	NA	NA - Assume no change post-fire	0.75
South east dry sclerophyll	5.0	3.00	0.10	4.00	NA	NA - Assume no change post-fire	0.68
Sydney hinterland dry sclerophyll	4.0	3.00	0.10	2.00	NA	NA - Assume no change post-fire	0.89
Southern tableland wet sclerophyll	4.0	3.00	0.10	3.00	NA	NA - Assume no change post-fire	0.79

Table S4. Overview of PHOENIX simulations.

	PHOENIX simulations			
	(1) Current operational	(2) Burn heterogeneity	(3) Burn heterogeneity and bark initial	(4) Burn heterogeneity, bark initial and bark steady-state
Fire history	Current operational	Modified by fire severity mapping to account for unburnt patches within fire perimeters	Modified by fire severity mapping to account for unburnt patches within fire perimeters	Modified by fire severity mapping to account for unburnt patches within fire perimeters
Bark fuel accumulation curves				
Initial fuel loads (*c*)	Current operational	Current operational	Assume no change in bark fuel loads following low severity fire	Assume no change in bark fuel loads following low severity fire
Steady state fuel loads (*r*+ *c*)	Current operational	Current operational	Current operational	Modified bark steady state fuel loads based on field data

Table S5. Mean density of live shrub (stems ha^{-1}) ± 1 standard error, and results of one-way ANOVA.

Mean density of live shrubs (stems ha^{-1}) ± 1 S.E.					
Forest type	unburnt	Low-moderate fire severity	High-extreme fire severity	*F*-value	*p*-value
Western slopes dry sclerophyll	9,796 ±5,152	5,433 ±4,316	7,996 ±1,948	0.35	0.71
South east dry sclerophyll	3,282 ±2,024	2,547 ±817	7,092 ±2,958	1.67	0.23
Sydney hinterland dry sclerophyll	8,809 ±4307	13,118 ±3851	18,132 ±3101	1.47	0.27
Southern tableland wet sclerophyll	622 ±226	339 ±312	1,188 ±901	0.61	0..56