

Supplementary Material

Table S1. Details of Sentinel 2 and Landsat 8 imagery used to map the 27 case study fires

Fire name	Fire Start date	Fire End date	Sentinel 2 pre-fire scene and date	Sentinel 2 post-fire scene and date	Landsat 8 pre-fire scene and date	Landsat 8 post-fire scene and date
Rockview	20190808	20190825	t56jmn_20190804	t56jmn_20190902	89/81_20190802	89/81_20190903
Raspberry Rd	20190907	20191027	t56jmm_20190903	t56jmm_20191106	89/81_20190903	89/81_20191106
Crown Mtn	20191202	20191224	t56jlm_20191106	t56jlm_20200105	89/81_20191106	89/81_20200109
Kaputar Rd	20191017	20191204	t56jkm_20191007	t56jkm_20191206	91/81_20191003	91/81_20191206
Hottes Rd	20190904	20190908	t56jkn_20190818	t56jkn_20190922	91/80_20190816	91/80_20190917
Carrot Farm Rd	20191211	20191225	t56jmn_20191206	t56jmn_20200105	89/81_20191208	89/81_20200109
Meads Ck West	20191126	20200122	t56hkk_20191106	t56hkk_20200130	90/82_20191113	90/82_20200201
Crumps Complex	20191127	20200124	t56hlj_20191106	t56hlj_20200219	89/83_20191106	90/83_20200217
Forest Rd	20191217	20200206	t56hkg_20191121	t56hkg_20200224	90/84_20191113	90/84_20200217
Nine Mile Complex	20191229	20200125	t55hfv_20191129	t55hfv_20200204	91/86_20191120	91/86_20200123
Yellow Bog Rd	20200109	20200207	t55hfa_20191216	t55hfa_20200227	91/85_20191222	91/85_20200224
Arkstone Rd	20191126	20191209	t55hgc_20191106	t55hgc_20191226	90/84_20191113	90/84_20191231
Clarence Way	20190809	20190825	t56jmn_20190808	t56jmn_20190907	89/81_20190802	89/81_20190903
Bangala Ck	20191204	20200115	t56jmp_20191116	t56jmp_20200320	90/80_20191113	90/80_20200320
Mummel Fire	20191202	20200115	t56jll_20191106	t56jll_20200320	89/82_20191106	89/82_20200313
Yearinan Station	20200109	20200121	t55jgf_20200108	t55jgf_20200313	91/82_20200107	91/82_20200311
Hamilton Rd	20180727	20180817	t56hlh_20180714	t56hlh_20180912	89/84_20180714	89/84_20180916
Orroral	20200127	20200227	t55hfa_20191216	t55hfa_20200320	90/85_20191215	90/85_20200320
Halls Creek Rd	20190103	20190204	t56jll_20181231	t56jll_20190219	90/81_20181228	90/81_20190214
Carters Rd	20191123	20200128	t56hlk_20191106	t56hlk_20200130	89/82_20191106	90/82_20200201
Mirrie Rd	20200122	20200206	t55hfe_20200108	t55hfe_20200313	91/82_20200107	91/82_20200311
Moonbi Range	20191112	20191209	t56jll_20191106	t56jll_20200105	90/81_20191028	90/81_20191231
Dunns Rd	20191228	20200215	t55hfa_20191216	t55hfa_20200315	91/85_20191222	91/85_20200311
Campbells Ck	20191207	20191224	t56jkg_20191116	t56jkg_20200110	90/80_20191113	90/80_20191231
Goddos Rd	20191027	20191128	t56jll_20191007	t56jll_20191206	90/82_20190926	90/82_20191215
Braidwood Rd	20190526	20190605	t56hkg_20190430	t56hkg_20190629	90/84_20190505	90/84_20190708
Wrights Ck	20191126	20191206	t56hlj_20191106	t56hlj_20191226	90/83_20191113	90/83_20191231

Table S2. Spectral and texture indices used in the Random Forest model to map fire extent and severity within the study. Formulas for the calculation of spectral indices are shown beneath the table.

Index name	Description
dNBR	differenced Normalised Burn Ratio
mean_dNBR_5	mean dNBR calculated within 5x5 pixel kernel
mean_dNBR_7	mean dNBR calculated within 7x7 pixel kernel
var_dNBR_5	variance of dNBR calculated within 5x5 pixel kernel
var_dNBR_7	variance of dNBR calculated within 7x7 pixel kernel
RdNBR	relativised dNBR
dFCB	change in Bare Fractional Cover
mean_dFCB_5	mean dFCB calculated within 5x5 pixel kernel
mean_dFCB_7	mean dFCB calculated within 7x7 pixel kernel
var_dFCB_5	variance of dFCB calculated within 5x5 pixel kernel
var_dFCB_7	variance of dFCB calculated within 7x7 pixel kernel
RdFCT	relativised change in Total Fractional Cover

$$preNBR = \left(\frac{pre\ NIR - pre\ SWIR}{pre\ NIR + pre\ SWIR} \right)$$

$$postNBR = \left(\frac{post\ NIR - post\ SWIR}{post\ NIR + post\ SWIR} \right)$$

$$dNBR = preNBR - postNBR$$

$$ABS\ pre\ NBR = |preNBR|$$

$$RdNBR = \left(\frac{dNBR}{sqrt(ABS\ pre\ NBR)} \right)$$

$$dFCB = post\ Bare - pre\ Bare$$

$$pre\ Total = pre\ Green + pre\ Non\ Green$$

$$post\ Total = post\ Green + post\ Non\ Green$$

$$RdFCT = \frac{pre\ Total - post\ Total}{sqrt(pre\ Total)}$$

Where: 'pre' refers to spectral values derived from pre-fire imagery, and: 'post' refers to spectral values derived from post-fire imagery

Table S3. Details of aerial imagery used to manually classify each of the 8 training fires.

Fire name	Fire Start date	Fire End date	Aerial photography	Aerial photography date
Sir Ivan	20170211	20170217	50 cm 4-band ADS	20170218
White Cedars	20170212	20170217	20 cm 4-band ADS	20170216
Wollemi	20180128	20180215	50 cm 4-band ADS	20180317
Mt Canobolas	20180210	20180216	30 cm 4-band ADS	20180309
Sir Bertram	20180120	20180125	50 cm 4-band ADS	20180311
Pilliga	20180119	20180125	50 cm 4-band ADS	20180311
Tathra	20180318	20180319	10 cm 4-band ADS	20180320
Holsworthy	20180413	20180418	50 cm 4-band ADS	20180424

Table S4. Balanced accuracy statistics for Sentinel 2 and Landsat 8 FESM algorithms for each of the 8 training fires.

Sentinel 2

Fire name	Size (ha)	# sample points	Balanced accuracy					
			Unburnt	Low	Moderate	High	Extreme	Overall
Sir Bertram	2241	8656	0.995	0.825	0.538	0.748	0.983	0.840
Holsworthy	3955	7722	0.985	0.798	0.729	0.763	0.939	0.766
Mt Canobolas	1891	10782	0.944	0.872	0.612	0.933	0.937	0.832
Sir Ivan	47105	17750	0.945	0.729	0.671	0.804	0.958	0.787
White Cedars	5217	18106	0.979	0.908	0.726	0.915	0.933	0.903
Tathra	1258	3131	0.967	0.845	0.726	0.842	0.972	0.773
Wollemi	14178	25427	0.989	0.831	0.648	0.906	0.949	0.831
Pilliga	57822	79076	0.998	0.804	0.592	0.774	0.605	0.668
average	16708	21331	0.975	0.827	0.655	0.836	0.909	0.800

Landsat 8

Fire name	Size (ha)	# sample points	Balanced accuracy					
			Unburnt	Low	Moderate	High	Extreme	Overall
Sir Bertram	2241	8656	0.994	0.958	0.884	0.745	0.711	0.633
Holsworthy	3955	7722	0.992	0.939	0.576	0.815	0.925	0.816
Mt Canobolas	1891	10782	0.958	0.883	0.747	0.758	0.867	0.841
Sir Ivan	47105	17750	0.885	0.662	0.609	0.644	0.954	0.834
White Cedars	5217	18106	0.996	0.949	0.756	0.916	0.960	0.909
Tathra	1258	3131	0.970	0.945	0.771	0.816	0.854	0.786
Wollemi	14178	25427	0.973	0.739	0.768	0.835	0.925	0.736
Pilliga	57822	79076	0.988	0.877	0.640	0.902	0.964	0.945
average	16708	21331	0.959	0.861	0.669	0.787	0.895	0.823