Supplementary Material

1 SUPPLEMENTARY DATA

Fuel measurements are taken to support fire behaviour measurements. Where possible these are co located with fire behaviour measurements.

1.1 Surface and canopy fuel loads

Surface fuel load conditions, including shrubs, fine fuels. and downed woody material were assessed from samples destructively harvested at each survey plot (Filkov et al., 2017; Mueller et al., 2017, 2018; Thomas et al., 2017). Surface fuels were samples at three randomly located 0.5 m circular harvest subplots within a 20 $\times$ 20 m area centered at each understory tower. Shrubs $\leq$ 2 m in height, woody material at the forest floor $\leq$ 7.62 cm diameter, and fine material were gathered. Post-burn sampling was conducted at three new random subplots within each of the nine 20 $\times$ 20 m plots. Fuels sampling at TT followed the same procedures only one pre- and post- burn samples was collected per 20 $\times$ 20 m plot.

Canopy fuel attributes for each plot were estimated from upward facing LiDAR data collected in each survey plot (Clark and Skowronski, 2010). Eleven evenly spaced 20 m transects in a 20 $\times$ 20 m square plot were scanned (Riegl laser rangefinder LD90-3100VHS-FLP, Riegl USA). The scanner was 2 m above the ground, providing estimates for fuels above that height. At PPS and PPN, plots were scanned both pre- and post-burn; no post-fire scans were made at TT because burning had no impact on the forest canopy. LiDAR data provided a 1 m resolution canopy height profile for each plot pre- and post-burn (Skowronski, 2011). This was used to calculate available canopy fuels (i.e. pine needles and 1-10 hour twigs) (Clark and Skowronski, 2010). Raw LiDAR data was also used to estimate maximum canopy height, mean canopy height, and percent cover in each plot.

Surface and canopy fuel loads are shown in Table S1. PPS and PPN sites had similar surface and canopy fuel loadings. The surface fuel loads were 0.6 to 0.74 kg/m^2 higher than at the TT site. The PPS and PPN units had more than twice the pre-burn fine fuel loading, than the TT unit reflecting the more recent burning history of this area. Canopy fuel loadings at PPS and PPN were similar. The height of the canopy base at TT meant that it was not impacted by the fire and no post-fire measurements were made.

1.2 Fuel moisture content

Samples of shrub, woody and fine fuels were gathered at separate locations before ignition. At PPS, fuel moisture was measured at PPS1, PPS2, PPS3. At PPN fuel moisture was measured at PPM5, PPN6 and in the area between PPN5 and PPN6. Fuel samples at TT were collected at random locations across the site. Fuel moisture was determined by measuring the ass change after drying samples for a minimum of 48 hours at 70°C. The moisture of live pitch pine needles and 1-hour live stems were derived from monthly moisture content data collected between 2009 and 2014 at a nearby site.

	Surface			Canopy		
Site	m_i, kg/m^2	Δm, kg/m^2	Δm, %	m_i, kg/m^2	Δm, kg/m^2	Δm, %
PPS	2.28 ± 0.40	1.39 ± 0.40	61	2.4 ± 0.4	0.2 ± 0.5	8
PPN	2.42 ± 0.35	1.85 ± 0.40	76	2.0 ± 0.2	0.4 ± 0.4	20
TT	1.68 ± 0.75	1.05 ± 0.83	63	–	–	–

Table S1. Summary of fuel loading before and after 3 prescribed burns. Load is described as average kg/m^2 $\pm$ 1 SD.

	PPS	n	PPN	n	TT	n
Litter	72 ± 6	3	34 ± 2.9	3	15 ± 4	10
Wood	32 ± 18	3	21 ± 11	3	11 ± 1	10
Stems Live	61 ± 35	3	57 ± 1	3	116 ± 29	4
Stems Dead		0		0	11 ± 2	4
Shrub Foliage Live		0		0	234 ± 29	8
Canopy Foliage	118 ± 11	10	121 ± 7	10	0	

Table S2. Moisture contents of fuels at three burn sites, shown as percent $\pm$ 1 SD.

Fuel moisture content for each fire is summarized in Table S2. The moisture content of forest floor fuels (litter and wood) were lowest at TT and highest at PPS. At PPS and PPN, all stems were assumed to be live, and foliage was not present given the dormant season conditions, hence no dead stem or foliage values are available for those burns (Table S2). High moisture contents were recorded in the live fuels at TT.

1.3 Temporally resolved fire behaviour and firebrand dynamics

The files `PPN_spread.mp4` and `PPS_spread.mp4` show the fire spread (as determined by FireTracker data) for the PPN and PPS fires, respectively. `PPN_spread.mp4` additionally shows the temporally resolved firebrand deposition to illustrate the relationship between these phenomena.

REFERENCES

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