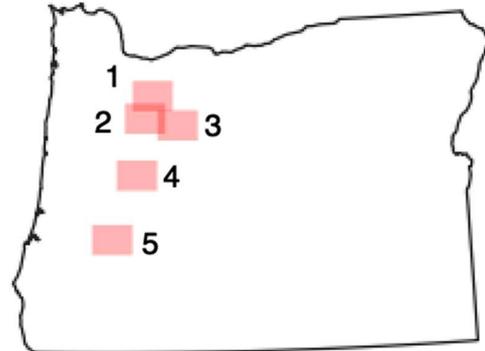
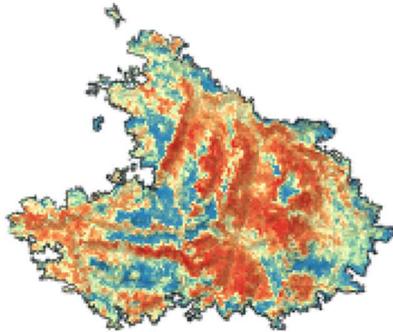


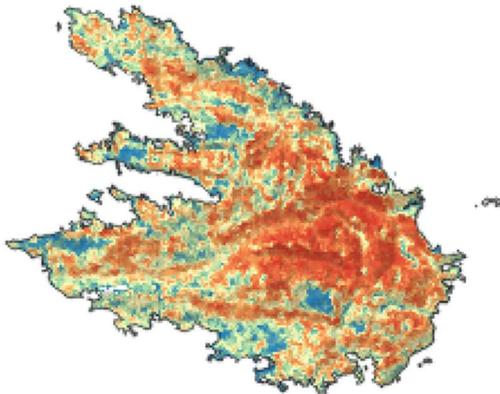
## 6. Supplementary Material

We modeled the drivers of burn severity within five Labor Day 2020 wildfire perimeters along a latitudinal gradient in the western Cascades of Oregon state; from north to south, these included the Riverside (55,901 ha, 45.10 N), Beachie Creek (78,364 ha, 44.84 N), Lionshead (82,802 ha, 44.76 N), Holiday Farm (70,171 ha, 44.15 N), and Archie Creek (53,241 ha, 43.36 N) fires. During this period, an extreme pressure gradient fueled strong easterly winds, atypical for this time of the year, which descended over the Cascade crest as adiabatic effects warmed and dried the air and maintained fuel moisture at extreme lows with no nighttime recovery. Onshore air flow returned on Sept 10, and while fuel moisture remained low, winds subsided, and relative humidity recovered at night. Combined with an inverted temperature column that formed at low elevation, fire activity in the post-wind period was constrained to higher elevations. The first of the fall rains began on September 17th. The fires burned 334,500 hectares in total, with the vast majority (80%) of fire growth occurring during the ca. 72 hr period between September 7th and 9th. Likewise, the proportion of the fire area that burned at high severity during the wind event was approximately three times that which occurred in the period that followed (65% vs. 26%).

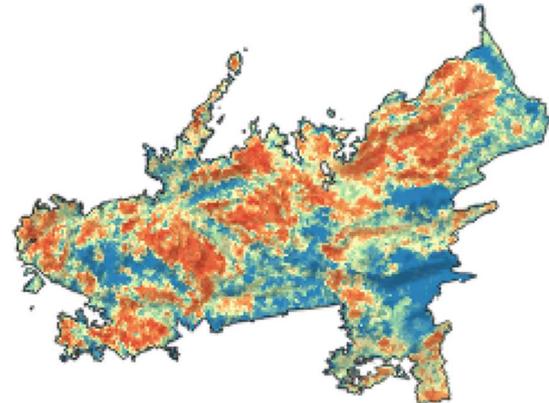
1 Riverside



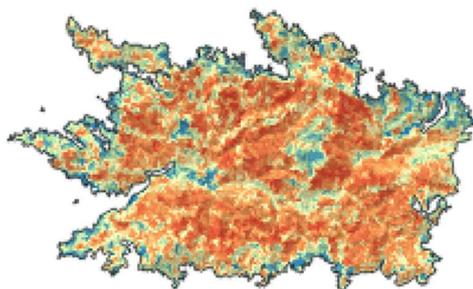
2 Beachie Creek



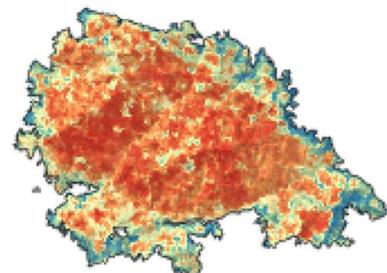
3 Lionshead



4 Holiday Farm



5 Archie Creek



**Figure S1.** Geographic locations, perimeters, and continuous burn severity estimates (dNBR; following histogram distribution from Figure S2) of the five wildfires analyzed in this study within the western Cascades of Oregon state.

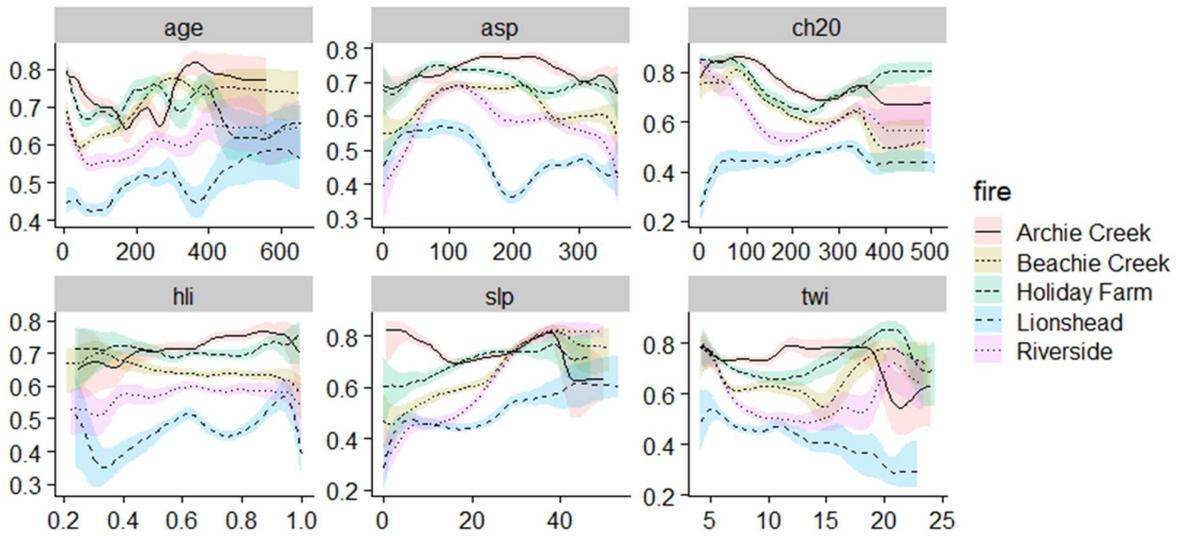


Figure S2. Partial dependence plots of most important variables by individual event (both periods combined).

Table S1. Percent of fire excluded from the analysis. Fires are listed latitudinally from S to N.

Row Labels	Hectares burned	Included (<1250m)	Excluded (<1250m)
Archie Creek	53,125	97.8% (97.1%)	2.2% (2.9%)
Holiday Farm	69,594	96.9% (92.3%)	3.1% (7.7%)
Beachie Creek	77,474	95.6% (89.6%)	4.4% (11.1%)
Lionshead	79,591	51.6% (32.6%)	48.4% (67.5%)
Riverside	54,645	94.9% (88.9%)	5.1% (11.1%)
Combined	334,429	87.0% (77.3%)	13.0% (22.7%)

Table S2. AUC and deviance explained for combined and separated samples and also filtered by both period and/or elevation below 1250m. The combined stratified sample was drawn equally from both periods despite substantial differences in area burned.

Sample	Training		Test	
	AUC	dev exp	AUC	dev exp
Combined random	0.91	0.40	0.77	0.17
Combined stratified	0.97	0.60	0.83	0.24
Period 1	0.88	0.33	0.75	0.15
Period 2	0.99	0.76	0.85	0.27
Stratified (<1250m)	0.97	0.61	0.84	0.26
Period 1 (<1250m)	0.90	0.37	0.76	0.16
Period 2 (<1250m)	0.99	0.80	0.87	0.29

Table S3. Area burned (ha) by fire (w/o excluded area). The totals presented here do not include areas burned during the Sept fires that did not meet the criteria detailed in the methods. Fires are listed latitudinally from S to N.

Row Labels	Hectares	Wind	Post Wind
Archie Creek	52,104	87.3%	12.7%
Holiday Farm	68,002	89.3%	10.7%

Beachie Creek	74,908	97.6%	2.4%
Lionshead	42,767	84.5%	15.5%
Riverside	53,066	88.2%	11.8%
Combined	290,847	90.2%	9.8%

**Table S4.** Percent high severity by burn period (w/o excluded area). The totals presented here do not include areas burned during the Sept fires that did not meet the criteria detailed in the methods. Fires are listed latitudinally from S to N.

Row Labels	Combined	Wind	Post Wind
Archie Creek	72.1%	79.5%	21.0%
Holiday Farm	68.5%	72.9%	32.0%
Beachie Creek	62.0%	63.2%	16.5%
Lionshead	47.5%	49.4%	36.9%
Riverside	56.4%	60.7%	24.3%
Combined	62.2%	65.9%	27.9%

**Table S5.** Variable importance within boosted regression trees for 12 independent variables, as shown in Figure 2 for the combined stratified sample (st), period 1 (p1), period (2), repeated using the 1250m filter.

rank	var	st	p1	p2	st_1250	p1_1250	p2_1250
1	Canopy height (ch)	14%	13%	22%	16%	13%	28%
2	Elevation (elv)	12%	12%	17%	10%	12%	12%
3	Period (period)	11%	-	-	12%	-	-
4	Slope (slp)	10%	13%	8%	11%	13%	8%
5	Aspect (asp)	8%	9%	8%	7%	9%	7%
6	Topographic wetness (twi)	8%	9%	7%	7%	9%	6%
7	Canopy cover (cc)	8%	9%	8%	8%	9%	9%
8	Topographic position (tpi)	7%	8%	6%	7%	8%	5%
9	Fire (fire)	7%	9%	5%	7%	9%	5%
10	Heat loading (hli)	7%	8%	9%	7%	8%	8%
11	Stand age (age)	6%	7%	6%	6%	7%	6%
12	Ownership (own)	2%	3%	5%	3%	3%	5%
	Topographic variables	52%	59%	55%	49%	59%	46%
	Veg structure variable	28%	29%	36%	30%	29%	43%

**Table S6.** Variable interactions among for combined stratified sample and separated by period. Only the top 10 interactions are shown (out of the 55 potential pairings). See methods and supplementary scripts for how interactions were calculated and Table S4 for variable abbreviations.

rank	combined (stratified)		period1		period2	
	var_combo	interaction	var_combo	interaction	var_combo	interaction
1	period:own	63.13	ch20:cc20	142.36	fire:elv	79.82
2	ch20:cc20	50.85	fire:slp	76.09	ch20:cc20	76.53
3	fire:elv	41.5	ch20:slp	50.57	ch20:elv	41.32
4	period:slp	36.95	fire:elv	49.37	slp:elv	38.91
5	period:elv	33.6	fire:own	47.77	fire:cc20	29.36
6	period:fire	27.85	fire:ch20	32.73	own:ch20	23.81
7	ch20:elv	21.56	own:elv	31.65	own:slp	23.6

8	period:ch20	13.65	fire:asp	17.68	own:elv	22.07
9	own:ch20	12.6	ch20:age	15.3	fire:own	22
10	period:asp	10.49	slp:elv	13.61	fire:ch20	17.17

**Table S7.** Area burned (ha) by ownership (w/o excluded area; 1 = BLM, 2 = ST ). The totals presented here do not include areas burned during the Sept fires that did not meet the criteria detailed in the methods. Fires are listed latitudinally from S to N.

Row Labels	USFS	Private	BLM	State
Archie Creek	19.9%	48.6%	31.5%	0%
Holiday Farm	18.5%	70.1%	10.9%	0.5%
Beachie Creek	27.0%	39.7%	20.8%	12.4%
Lionshead	93.3%	6.3%	0.0% <sup>2</sup>	0.5%
Riverside	61.5%	30.1%	8.4% <sup>1</sup>	0%
Combined	39.8%	41.7%	18.5%	100%

**Table S8.** Percent of high severity (i.e., >75% tree mortality) by ownership. Fires are listed latitudinally from S to N.

Row Labels	USFS	Private	Other
Archie Creek	47%	55%	47%
Holiday Farm	42%	55%	45%
Beachie Creek	60%	38%	27%
Lionshead	43%	21%	43%
Riverside	38%	43%	35%
Grand Total	46%	42%	39%