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Assessing climate change impacts on live fuel moisture and wildfire risk using a hydrodynamic vegetation model

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Table S1. Soil texture information for 10 layers at Stunt Ranch based on the soil survey database Sun et al. (2016).

Soil depth (m)	Percent Clay (%)	Percent Sand (%)	Percent Organic (%)	Bulk density (g/cm3)	Organic density (kg/m3)
0.007101	5.5	55	3.5	1.15	80.5
0.027925	5.5	55	3.5	1.15	80.5
0.062259	5.5	55	3.5	1.15	80.5
0.118865	6.2	53	2.42	1.15	55.66
0.212193	7.6	49	0.25	1.15	5.75
0.366066	7.5	58	0.25	1.13	5.65
0.619758	7.3	77	0.25	1.1	5.5
1.038027	7.3	77	0.25	1.1	5.5
1.727635	7.3	77	0.25	1.1	5.5
2.864607	7.3	77	0.25	1.1	5.5

Table S2. Allometry, leaf and wood traits, and hydraulic traits of 11 chaparral shrub species in Stunt Ranch.

Traits\species	**Af**	**Cc**	**As**	**Ag**	**Cs**	**Ml**	**Ro**	**Ri**	**Cb**	**Ha**	**Qb**
Fates_allom_d2h1	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24
Fates_allom_d2h2	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39
Fates_allom_dbh_maxheight	2.26	3.41	4.15	2.07	4.25	3.23	3.25	3.02	4.15	4.15	3.23
Fates_allom_agb1	0.1162	0.1162	0.1162	0.1162	0.1162	0.1162	0.1162	0.1162	0.1162	0.1162	0.1162
Fates_allom_agb2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Fates_allom_agb3	2.126	2.126	2.126	2.126	2.126	2.126	2.126	2.126	2.126	2.126	2.126
Fates_allom_agb4	0.931	0.931	0.931	0.931	0.931	0.931	0.931	0.931	0.931	0.931	0.931
Fates_allom_d2bl1	0.2463	0.2463	0.2463	0.2463	0.2463	0.2463	0.2463	0.2463	0.2463	0.2463	0.2463
Fates_allom_d2bl2	1.022	1.022	1.022	1.022	1.022	1.022	1.022	1.022	1.022	1.022	1.022
Fates_allom_d2ca_max	3.93	3.16	11.42	0.54	1.81	2.52	9.70	5.29	11.42	11.42	2.52
Specific leaf area ($m^2 \cdot gC^{-1}$)	0.0059	0.0043	0.0114	0.0052	0.0069	0.0052	0.0044	0.0085	0.0100	0.0041	0.0074
Max carboxylation rate at 25°C ($\mu mol \cdot m^{-2} \cdot s^{-1}$)	41	57	41	37	57	51	51	57	64	33	52
Wood density ($g \cdot cm^{-3}$)	0.679	0.678	0.620	0.662	0.615	0.497	0.523	0.706	0.667	0.608	0.724
Maximum xylem conductivity per area ($kg \cdot MPa^{-1} \cdot m^{-1} \cdot s^{-1}$)	0.642	0.553	1.550	1.267	1.517	5.710	1.640	0.606	2.032	2.264	3.375
Xylem water potential at 50% loss of conductivity (MPa)	-7.33	-7.19	-4.65	-5.09	-4.14	-0.52	-0.56	-7.20	-7.50	-6.20	-1.51
Leaf water potential at 50% loss of stomatal conductivity (MPa)	-3.61	-5.06	-3.61	-3.36	-2.91	-1.93	-1.78	-2.91	-3.61	-3.61	-3.73
Osmotic potential at turgor loss point (Mpa)	-3.397	-3.658	-2.326	-2.514	-2.797	-2.071	-1.563	-3.126	-2.023	-2.702	-1.968
Osmotic potential at full turgor (Mpa)	-2.693	-3.658	-1.659	-1.800	-2.151	-1.585	-1.225	-2.956	-1.406	-1.900	-1.523

Note: Chamise (*Adenostoma fasciculatum* – Af, PFT-LA), red shank (*Adenostoma sparsifolium* – As, PFT-LA), big berry manzanita (*Arctostaphylos glauca* – Ag, PFT-LA), buck brush (*Ceanothus cuneatus* – Cc, PFT-HA), greenbark ceanothus (*Ceanothus spinosus* – Cs, PFT-HA), mountain mahogany (*Cercocarpus betuloides* – Cb, PFT-HA), toyon (*Heteromeles arbutifolia* – Ha, PFT-LA), laurel sumac (*Malosma laurina* – Ml, PFT-MC), scrub oak (*Quercus berberidifolia* – Qb, PFT-MC), hollyleaf redberry (*Rhamnus ilicifolia* – Ri, PFT-HA), and sugar bush (*Rhus ovata* – Ro, PFT-MC).

Table S3. Allometry, leaf and wood traits, and hydraulic traits of three PFTs in Stunt Ranch.

Traits\species	PFT-LA	PFT-MC	PFT-HA
Fates_allom_d2h1	1.24	1.24	1.24
Fates_allom_d2h2	0.39	0.39	0.39
Fates_allom_dbh_maxheight	3.18	3.24	3.73
Fates_allom_agb1	0.12	0.12	0.12
Fates_allom_agb2	0.00	0.00	0.00
Fates_allom_agb3	2.13	2.13	2.13
Fates_allom_agb4	0.93	0.93	0.93
Fates_allom_d2bl1	0.25	0.25	0.25
Fates_allom_d2bl2	1.02	1.02	1.02
Fates_allom_d2ca_max	4.96	9.15	11.42
Specific leaf area ($m^2 \cdot gC^{-1}$)	0.007	0.005	0.007
Max carboxylation rate at 25°C ($\mu mol \cdot m^{-2} \cdot s^{-1}$)	38.00	51.33	58.75
Wood density ($g \cdot cm^{-3}$)	0.64	0.58	0.67
Maximum xylem conductivity per area ($kg \cdot MPa^{-1} \cdot m^{-1} \cdot s^{-1}$)	1.43	3.58	1.18
Xylem water potential at 50% loss of conductivity (MPa)	-5.82	-0.86	-6.51
Leaf water potential at 50% loss of stomatal conductivity (MPa)	-3.55	-2.48	-3.62
Osmotic potential at turgor loss point (Mpa)	-2.73	-1.87	-2.90
Osmotic potential at full turgor (Mpa)	-2.01	-1.44	-2.13

Table S4. Number of days per year of live fuel moisture content below 79% of three PFTs under RCP 4.5 and 8.5 from the historical period 1960-1999 to the future period 2080-2099.

Periods	79%					
	RCP4.5			RCP8.5		
	PFT-LA	PFT-MC	PFT-HA	PFT-LA	PFT-MC	PFT-HA
Historical	135	101	156	135	101	156
Future	145	113	165	156	124	176

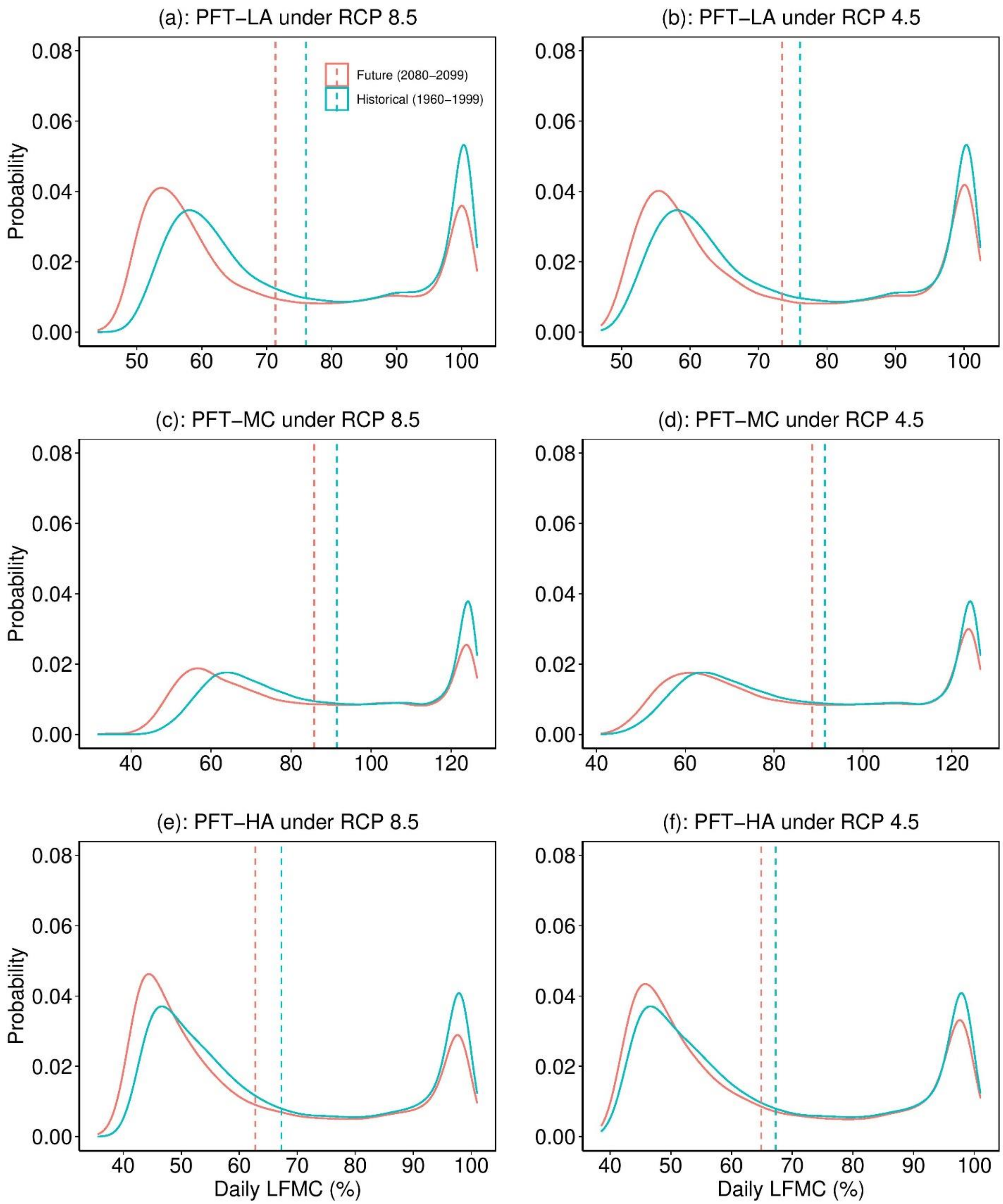

Fig.S1 Comparisons on histogram of daily mean live fuel moisture content considering all climatic variables changes during dry season between future period (2080-2099) and historical period (1960-1999) for three PFTs (refer to Figure 1 for explanation of the PFTs) under climate scenario RCP 4.5 and 8.5.

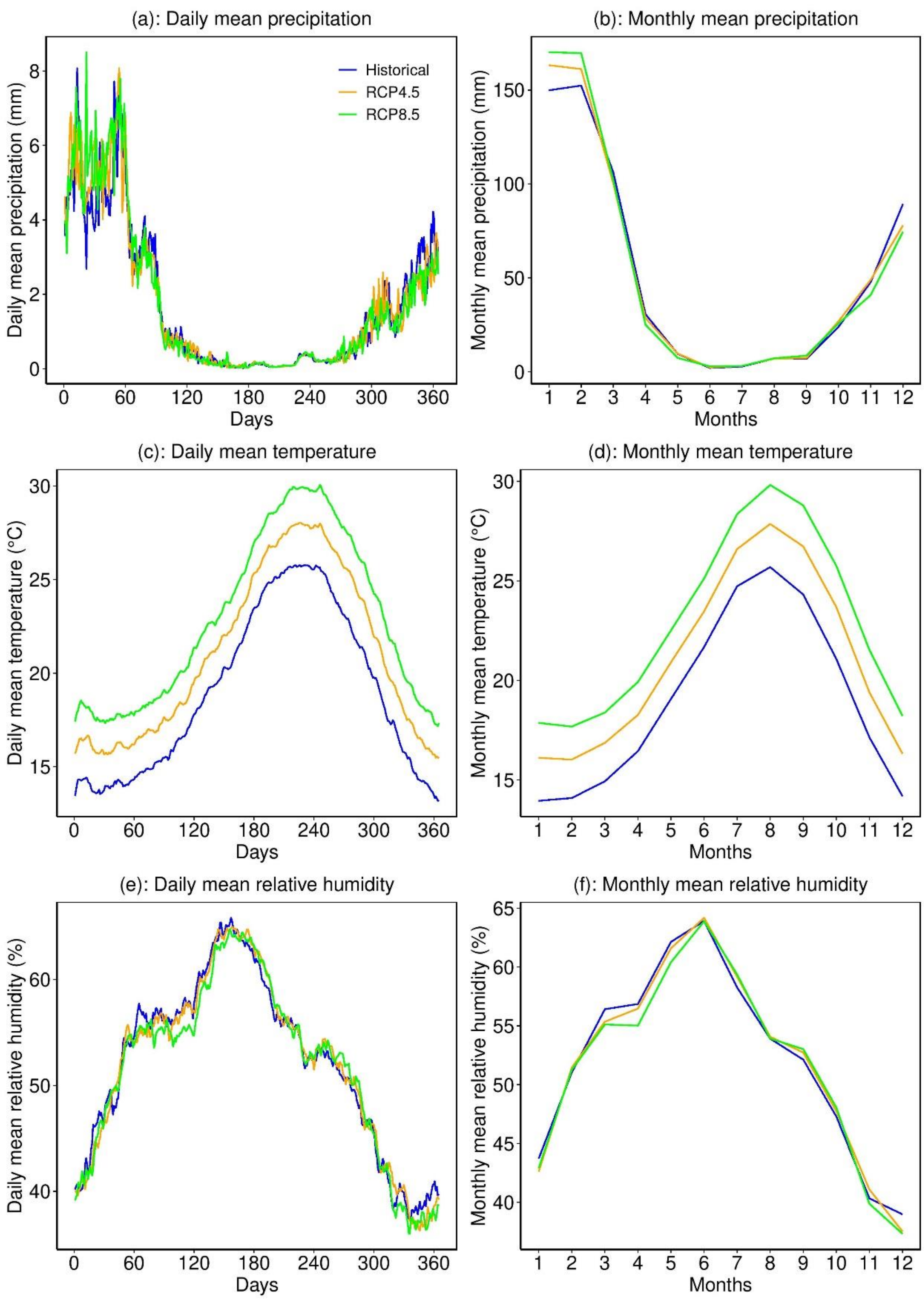

Fig.S2 Daily and monthly mean precipitation, temperature, relative humidity changes from historical data and future data under RCP 4.5 and 8.5 during 2080-2099.

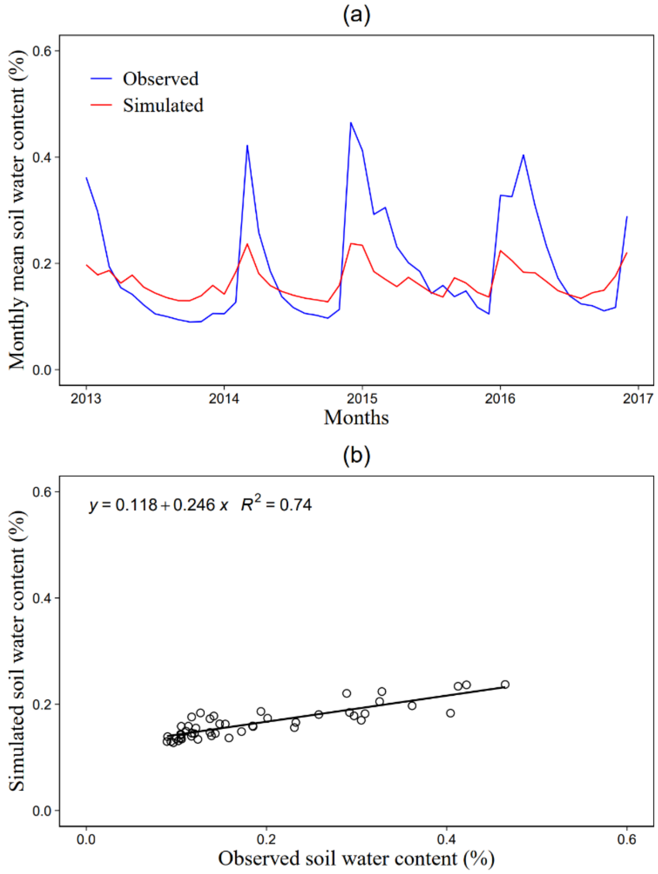

Fig.S3 Simulated and observed monthly soil water content in soil layer 3 (5-cm depth) and related R^2 value of their comparison.

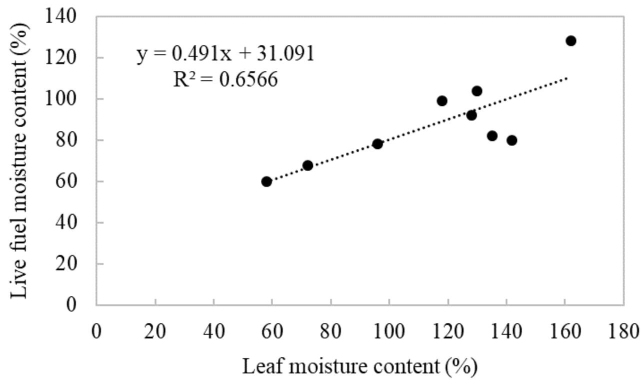

Fig.S4 Empirical equation derived from shrub live fuel moisture content and leaf moisture content data including the three regenerative strategies [seeder (S), resprouter (R) and seeder–resprouter (SR)], in summer, autumn and winter from Figures 4 and 5 in Saura-Mas and Lloret's study (2007).

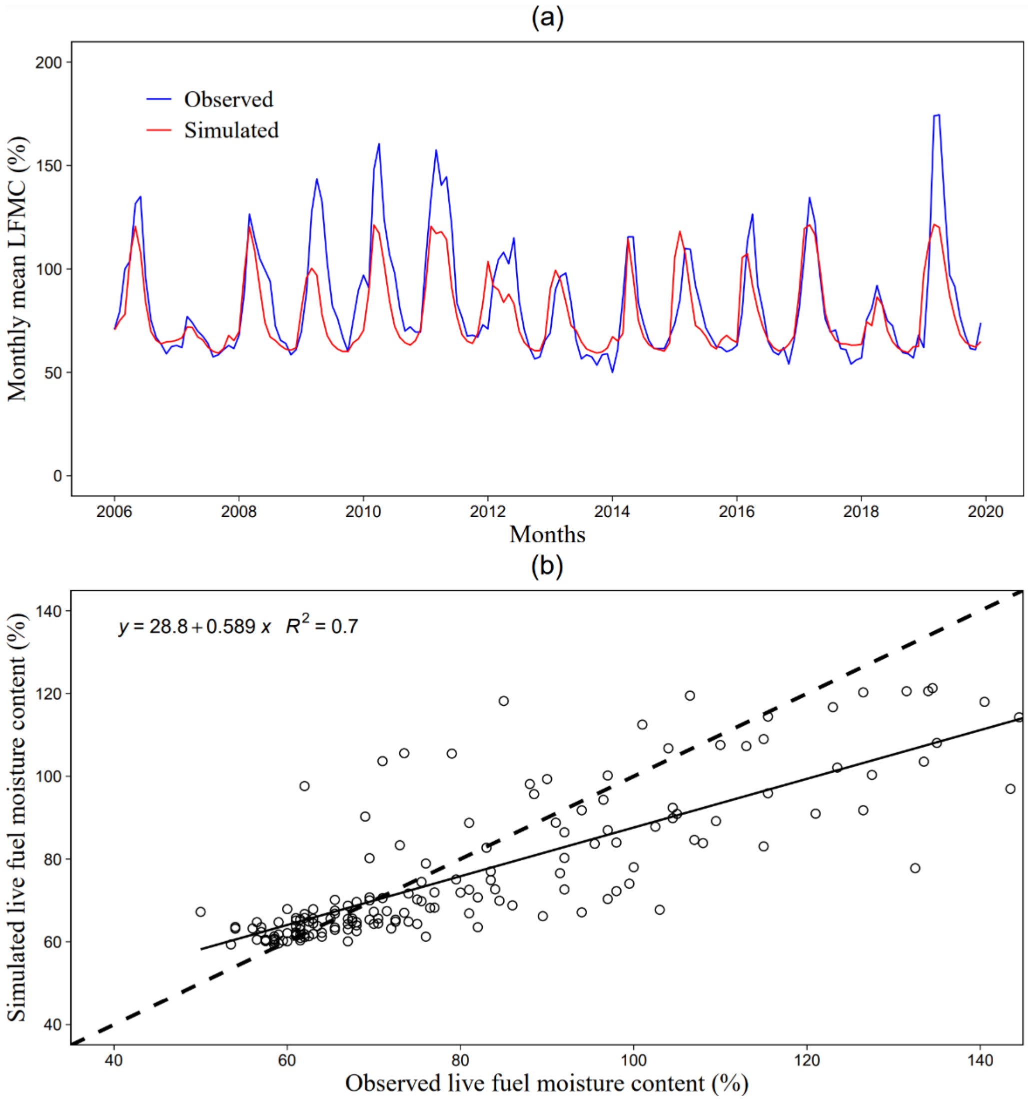

Fig.S5 Model validation based on multi-year observations of monthly live fuel moisture of chamise (*Adenostoma fasiculatum*) from the National Fuel Moisture Database (2021) in Stunt Ranch at Santa Monica Mountain. We simulated LFMC for PFT-LA including chamise during 2006-2019 to evaluate the model prediction in panel a). Panel b) shows the R^2 value and the 1:1 line to assess the model performance.

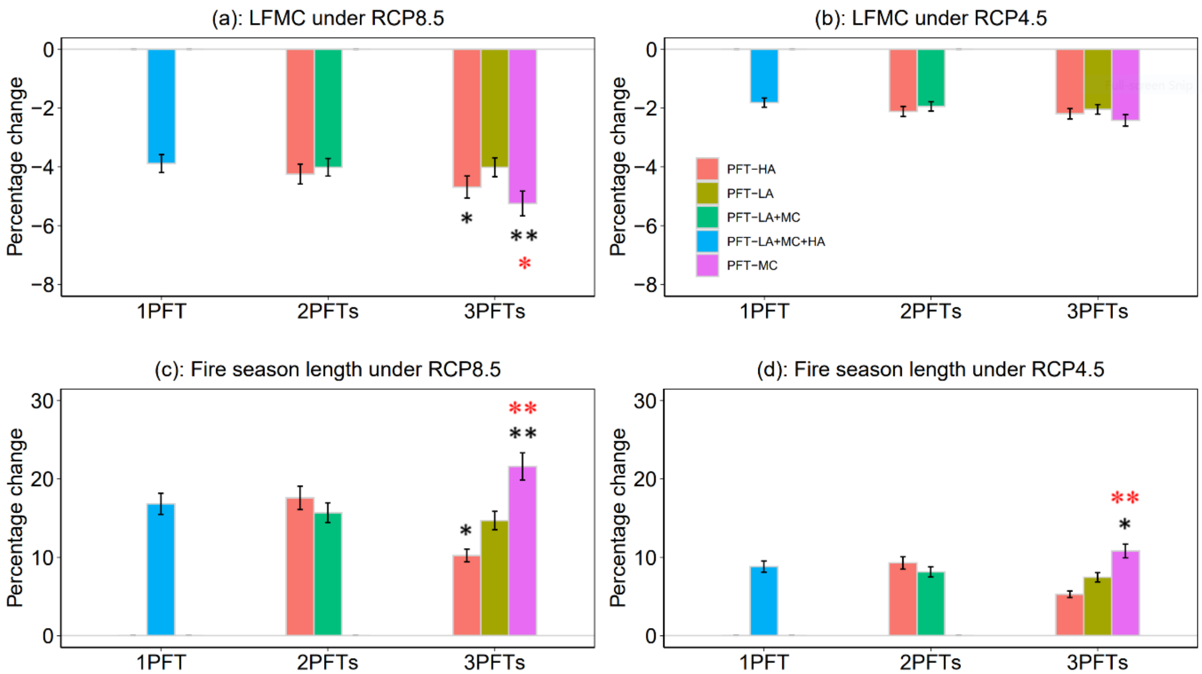

Fig.S6 Percentage change of live fuel moisture content and fire season length between future period (2080-2099) and historical period (1960-1999) using one PFT, two PFTs, and three PFTs under climate scenarios RCP 4.5 and 8.5. For one PFT, PFT-LA+MC+HA (blue) uses average trait values of PFT−LA, PFT−MC, and PFT−HA. For two PFTs, PFT-LA+MC (green) uses average trait values of PFT−LA and PFT−MC, and PFT-HA (red) uses trait value of PFT−HA. For three PFTs, each PFT (dark yellow, pink, red) uses average trait values of species listed in the Table S2. Black ** ($p < 0.01$) and * ($p < 0.05$) represent significant difference in LFMC and fire season length for PFT−MC and PFT−HA compared to PFT−LA. Red ** ($p < 0.01$) and * ($p < 0.05$) represent significant difference in LFMC and fire season length between PFT−MC and PFT−HA.