

## Supplementary Materials

**Table S1.** Study site locations of all burned and reference SNOTEL sites used in analyses for each snow-eco-region, including Alaska (AK), Arizona/New Mexico (AZ/NM), Cascades (CA), Northern Rockies (NR), Middle Rockies (MR), Southern Rockies (SR), Wasatch/Uinta (W/U), and Western Interior (WI). Also included is the SNOTEL site identification number (Site\_ID), State, Fire Year, Latitude, Longitude, Elevation, and burn severity (Severity) of forest fire which occurred during the period of record.

Site Type	Region	Site_ID	State	Fire Year	Latitude	Longitude	Elevation	Severity
Burned	AK	947	AK	2004	65.12	−146.73	2000	NA
Burned	AK	949	AK	2004	65.08	−145.87	1850	L
Burned	AZ/NM	519	AZ	2002	34.31	−110.75	7640	U
Burned	AZ/NM	902	AZ	2011	33.69	−109.22	7990	U
Burned	AZ/NM	416	AZ	2011	33.80	−109.15	8400	H
Burned	AZ/NM	511	AZ	2011	33.65	−109.31	9020	U
Burned	AZ/NM	617	AZ	2011	33.92	−109.46	9200	U
Burned	AZ/NM	1127	AZ	2011	33.90	−109.16	8500	L
Burned	AZ/NM	866	AZ	2011	33.76	−109.48	7850	L
Burned	AZ/NM	877	AZ	2000	33.90	−109.16	8500	L
Burned	AZ/NM	595	NM	2003	33.36	−107.83	8500	L
Burned	AZ/NM	1138	NM	2005	36.18	−108.95	9050	L
Burned	AZ/NM	1034	NM	2012	33.40	−105.79	10280	M
Burned	AZ/NM	757	NM	2012	33.37	−108.71	9000	L
Burned	AZ/NM	1048	NM	2013	33.01	−107.87	9240	U
Burned	AZ/NM	755	NM	2014	32.92	−108.15	8360	H
Burned	CA	1258	CA	2012	41.99	−120.72	5680	M
Burned	CA	977	CA	2012	41.89	−120.75	5170	L
Burned	CA	706	OR	1992	42.32	−120.83	5720	L
Burned	CA	756	OR	2002	42.96	−121.18	5740	L
Burned	CA	526	OR	2003	44.42	−121.86	4790	L
Burned	CA	815	OR	2012	44.14	−121.64	5690	L
Burned	CA	800	OR	2018	42.70	−120.80	7080	M
Burned	CA	515	WA	2003	48.72	−120.66	6490	U
Burned	CA	824	WA	2006	46.12	−117.85	5530	U
Burned	CA	507	WA	2012	47.28	−120.49	5390	H
Burned	CA	699	WA	2014	47.99	−120.57	3590	M
Burned	CA	644	WA	2012	48.36	−119.08	5010	L
Burned	CA	1043	WA	2015	48.86	−118.40	4680	H
Burned	CA	418	WA	2017	47.02	−121.46	5800	H
Burned	CA	734	WA	2017	47.38	−121.06	4340	L
Burned	MR	639	ID	2018	44.84	−114.27	7600	L
Burned	MR	670	WY	1988	45.01	−110.01	7350	U
Burned	MR	862	WY	1988	45.05	−109.91	8700	U
Burned	MR	577	WY	1988	44.21	−110.67	7850	L
Burned	MR	683	WY	1988	44.73	−109.91	9400	U
Burned	MR	816	WY	1988	44.37	−110.58	7980	U
Burned	MR	837	WY	1988	44.15	−110.22	9240	U
Burned	MR	875	WY	1988	40.82	−106.75	9320	H
Burned	MR	358	WY	2007	44.68	−107.58	9350	M
Burned	MR	765	WY	2012	42.49	−110.53	8060	L
Burned	MR	379	WY	2013	43.70	−109.67	8750	H

Burned	MR	878	WY	2013	43.93	−109.82	8350	L
Burned	MR	460	WY	2018	43.13	−110.20	7930	L
Burned	NR	1053	ID	2003	48.72	−116.46	3520	M
Burned	NR	520	ID	2015	46.48	−115.63	5810	L
Burned	NR	510	MT	1994	48.31	−114.84	5035	L
Burned	NR	693	MT	2007	48.30	−113.33	5930	H
Burned	NR	414	MT	2003	47.08	−112.73	6950	M
Burned	NR	562	MT	2003	47.43	−113.78	4750	M
Burned	NR	413	MT	2003	47.06	−112.60	5200	M
Burned	SR	940	CO	2002	40.82	−106.75	9320	M
Burned	SR	827	CO	2002	40.00	−107.24	9700	H
Burned	SR	624	CO	2013	37.62	−107.03	11250	L
Burned	SR	461	UT	2002	39.31	−109.53	8302	M
Burned	SR	708	NM	2011	35.92	−106.39	9500	U
Burned	W/U	579	UT	2002	40.86	−110.80	9133	U
Burned	W/U	1269	UT	2003	37.98	−110.79	9209	NA
Burned	W/U	907	UT	2008	37.52	−112.27	8900	U
Burned	W/U	390	UT	2017	37.66	−112.74	9607	L
Burned	W/U	1197	UT	2017	37.75	−112.77	8692	NA
Burned	W/U	400	UT	2018	39.89	−111.25	7837	L
Burned	W/U	686	UT	2018	39.93	−111.63	8044	U
Burned	W/U	1280	UT	2018	39.92	−111.72	7835	U
Burned	WI	496	ID	1994	43.95	−115.27	5690	U
Burned	WI	740	ID	1994	45.19	−115.97	6540	H
Burned	WI	306	ID	2003	43.76	−115.24	7580	M
Burned	WI	439	ID	2007	44.55	−115.56	6860	L
Burned	WI	830	ID	2012	43.63	−115.44	7770	M
Burned	WI	450	ID	2013	43.60	−114.67	8420	M
Burned	WI	2029	ID	2015	43.29	−116.84	5600	L
Burned	WI	637	ID	2016	43.93	−115.67	6100	L
Burned	WI	445	NV	2012	41.97	−118.19	6260	M
Burned	WI	569	NV	2012	41.52	−117.63	6395	M
Burned	WI	1110	NV	2013	36.25	−115.63	7860	M
Burned	WI	573	NV	2018	41.78	−116.03	6682	L
Burned	WI	1146	UT	1986	39.35	−112.33	7850	U
Burned	WI	583	UT	2004	37.49	−113.85	6065	L
Reference	AK	948	AK	NA	65.25	−146.15	2800	NA
Reference	AK	951	AK	NA	64.95	−145.52	1640	NA
Reference	AZ/NM	310	AZ	NA	33.98	−109.50	9125	NA
Reference	AZ/NM	705	AZ	NA	34.37	−111.01	7930	NA
Reference	AZ/NM	1143	AZ	NA	36.33	−109.06	9200	NA
Reference	AZ/NM	486	NM	NA	33.74	−108.95	8000	NA
Reference	CA	434	OR	NA	44.52	−122.09	3690	NA
Reference	CA	552	OR	NA	44.39	−122.17	3520	NA
Reference	CA	614	OR	NA	44.59	−121.97	2590	NA
Reference	CA	619	OR	NA	44.21	−121.87	4770	NA
Reference	CA	733	OR	NA	44.44	−121.95	3740	NA
Reference	CA	794	OR	NA	42.13	−120.84	5770	NA
Reference	CA	1010	OR	NA	42.64	−120.95	6180	NA
Reference	CA	1166	OR	NA	44.33	−122.09	4720	NA
Reference	CA	1167	OR	NA	44.30	−122.04	3270	NA

Reference	CA	352	WA	NA	47.35	−120.68	4240	NA
Reference	CA	478	WA	NA	47.54	−121.09	3430	NA
Reference	CA	642	WA	NA	46.91	−121.48	5410	NA
Reference	CA	711	WA	NA	48.52	−120.74	4890	NA
Reference	CA	788	WA	NA	47.27	−121.34	3850	NA
Reference	CA	832	WA	NA	47.23	−120.29	5480	NA
Reference	CA	841	WA	NA	47.29	−120.37	4330	NA
Reference	CA	928	WA	NA	47.07	−121.59	2250	NA
Reference	CA	975	WA	NA	48.57	−120.78	3930	NA
Reference	CA	1068	WA	NA	47.16	−121.42	4640	NA
Reference	CA	1085	WA	NA	46.87	−121.53	5240	NA
Reference	CA	1171	WA	NA	48.07	−120.85	2930	NA
Reference	MR	480	MT	NA	45.06	−109.94	9100	NA
Reference	MR	670	MT	NA	45.01	−110.01	7350	NA
Reference	MR	862	MT	NA	45.05	−109.91	8700	NA
Reference	MR	309	WY	NA	44.80	−107.84	9380	NA
Reference	MR	326	WY	NA	44.94	−109.57	9360	NA
Reference	MR	377	WY	NA	44.79	−107.53	7880	NA
Reference	MR	451	WY	NA	44.57	−107.30	8880	NA
Reference	MR	472	WY	NA	44.65	−109.78	9200	NA
Reference	MR	499	WY	NA	44.13	−110.83	7265	NA
Reference	MR	555	WY	NA	43.25	−110.02	7740	NA
Reference	MR	585	WY	NA	43.50	−109.75	9370	NA
Reference	MR	597	WY	NA	43.17	−110.14	8240	NA
Reference	MR	661	WY	NA	43.11	−109.95	8340	NA
Reference	MR	751	WY	NA	44.50	−107.43	9580	NA
Reference	MR	764	WY	NA	44.13	−110.67	6920	NA
Reference	MR	779	WY	NA	42.53	−110.66	9000	NA
Reference	MR	798	WY	NA	44.72	−107.40	8880	NA
Reference	MR	818	WY	NA	44.81	−107.41	6870	NA
Reference	MR	1130	WY	NA	43.67	−109.38	8400	NA
Reference	NR	747	ID	NA	46.57	−115.74	4600	NA
Reference	NR	1142	ID	NA	46.50	−115.80	3080	NA
Reference	NR	667	MT	NA	47.27	−113.76	6330	NA
Reference	SR	426	CO	NA	40.17	−107.06	9100	NA
Reference	SR	467	CO	NA	40.85	−106.97	8700	NA
Reference	SR	717	CO	NA	40.11	−107.29	10340	NA
Reference	SR	839	CO	NA	37.72	−107.26	9400	NA
Reference	SR	840	CO	NA	37.49	−106.84	10200	NA
Reference	SR	1061	CO	NA	40.06	−107.01	9080	NA
Reference	W/U	392	UT	NA	40.85	−111.05	9171	NA
Reference	W/U	393	UT	NA	40.89	−111.07	8208	NA
Reference	W/U	399	UT	NA	39.87	−111.28	8975	NA
Reference	W/U	513	UT	NA	40.74	−110.62	10885	NA
Reference	W/U	514	UT	NA	37.49	−112.58	7792	NA
Reference	W/U	517	UT	NA	40.80	−110.88	9130	NA
Reference	W/U	593	UT	NA	37.49	−112.51	7465	NA
Reference	W/U	626	UT	NA	37.57	−112.84	9827	NA
Reference	W/U	763	UT	NA	40.79	−111.09	7631	NA
Reference	W/U	790	UT	NA	40.91	−110.50	10158	NA
Reference	W/U	853	UT	NA	37.58	−112.90	9203	NA

Reference	W/U	864	UT	NA	39.96	−110.99	8641	NA
Reference	W/U	992	UT	NA	40.89	−110.83	8777	NA
Reference	W/U	1135	UT	NA	40.98	−110.85	8000	NA
Reference	W/U	1148	UT	NA	37.70	−112.65	8350	NA
Reference	W/U	1154	UT	NA	37.68	−112.86	10039	NA
Reference	W/U	1162	UT	NA	40.96	−110.58	8869	NA
Reference	W/U	1163	UT	NA	40.88	−110.54	9360	NA
Reference	W/U	1192	UT	NA	40.84	−110.66	9632	NA
Reference	W/U	1248	UT	NA	37.60	−112.93	8050	NA
Reference	W/U	1261	UT	NA	38.07	−110.77	9410	NA
Reference	WI	338	ID	NA	44.63	−115.80	6560	NA
Reference	WI	370	ID	NA	45.04	−116.13	6250	NA
Reference	WI	550	ID	NA	44.05	−115.44	7070	NA
Reference	WI	704	ID	NA	43.51	−115.57	4800	NA
Reference	WI	769	ID	NA	43.48	−114.83	5740	NA
Reference	WI	476	NV	NA	41.82	−116.10	7031	NA
Reference	WI	498	NV	NA	41.67	−117.57	8503	NA
Reference	WI	548	NV	NA	41.55	−116.01	7377	NA
Reference	WI	549	NV	NA	41.51	−116.01	8424	NA
Reference	WI	1111	NV	NA	36.32	−115.70	8890	NA
Reference	WI	1112	NV	NA	36.31	−115.68	8626	NA
Reference	WI	1207	NV	NA	41.89	−115.86	6915	NA
Reference	WI	1079	OR	NA	45.98	−117.95	5580	NA
Reference	WI	1065	UT	NA	37.50	−113.94	6763	NA
Reference	WI	984	WA	NA	46.18	−117.54	5700	NA

**Table S2.** Burn severity intensifies forest fire effect on snow-water storage and snowmelt. Mean difference and significance of t-tests comparing normalized pre-fire vs. post-fire snow metrics of burned SNOTEL sites of high severity burned forest, moderate severity burned forest, low severity burned forest and unburned forest within the burn perimeter, for the western US and each snow-eco-region. Significance of the difference between the normalized pre- and post-fire snow metrics for the West and each region are shown as asterixis (\*\*\*\*  $p$ -value < 0.001, \*\*\*  $p$ -value < 0.01, \*\*  $p$ -value < 0.05, \*  $p$ -value < 0.1).

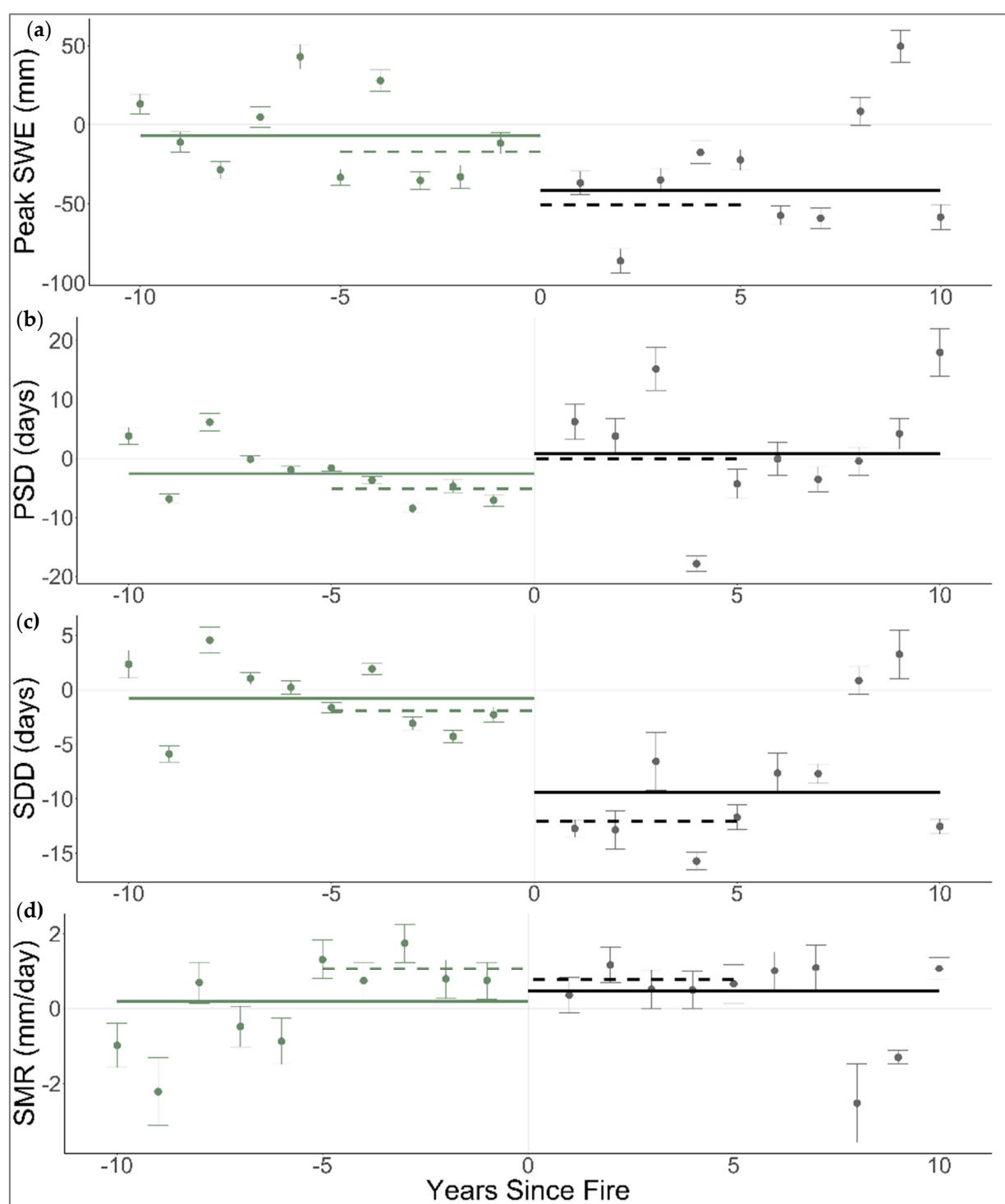
Region	$\Delta$ PSD (days)		$\Delta$ Peak SWE (mm)		$\Delta$ SDD (days)		$\Delta$ SMR (mm/day)	
	5 Years	10 Years	5 Years	10 Years	5 Years	10 Years	5 Years	10 Years
West—H N = 10	11.1	7.2	−63.5 *	−85.9 ***	−16.2 ****	−13.4 ****	0.7	2.7 ***
West—M N = 17	2.4	2.1	−22.4	−23.2	−19.7 ****	−14.8 ****	−0.6	0.4
West—L N = 29	9.1 *	6.8	−35.6	−36.0 *	−3.8	−4.0	−0.3	0.1
West—U N = 19	−1.0	−2.3	−21.3	−17.5	−7.1 ***	−7.9 ****	−0.6	0.5
Alaska—H N = 1	−9.1	11.8	−47.8 *	−34.3 **	−12.4 **	8.5	0.3	−13.1
Alaska—L N = 1	−13.4	−2.4	−22.9	−16.1	−11.3 **	−4.4	1.3	−0.3
Cascades—H N = 3	−3.1	−4.9	−22.0	−39.2	−17.4 ****	−16.3 ****	−3.1 *	−1.7 ***
Cascades—M N = 3	−1.9	−2.4	19.0	−22.0	−10.6 *	−14.2 ***	−2.3 *	−2.1 **
Cascades—L	29.5	25.5 **	−84.9	−100.9 **	−1.4 **	−1.5 **	−0.3	0.8

N = 7 Cascades—U N = 2	4.5	1.7	21.6	−73.4	−1.1	−1.9	−4.3	−1.4
North Rockies— H N = 1	6	18.1	−80.4	−279.8 ***	−0.9 **	−16.2 ****	−0.4	4.0 *
North Rockies— M N = 4	−11	−7.8	−24.6*	−9.3 *	−21.3 **	−16.1 ***	−1.7	−1.0
North Rockies— L N = 2	−10.6 *	−8.2 **	−82.5	−51.9 **	−17.2 **	−10.3 *	0.4	0.8
Middle Rock- ies—H N = 2	−18.5	−23.0 **	−52.5	4.8	−14 *	−13.3 **	2.0	2.1 **
Middle Rock- ies—M N = 1	7.9	6	118.6	58.8	7.3	2.5	−3.4	−2.7
Middle Rock- ies—L N = 5	12.5	9.2	−54.5	−13.6	−1.6	−2.4	1.0	−0.6
Middle Rock- ies—U N = 5	2.4	−1.1	3.0	54.7	−1.2	−2.9	0.9	−1.3
South Rockies— H N = 1	−18.5 *	−16.0 *	−226.8 *	−195.2 *	−14.1 ***	−13.7 *	7.6 *	5.3 *
South Rockies— M N = 2	−10.3– 18.5 *	−1.4–16.0 **	−25.9– 226.8 *	30.1–195.4 **	−9.6–14.1 ****	−4.0–13.7 **	−0.77.6 *	−1.15.3 **
South Rockies— L N = 1	0.3	−6.3 **	−93.9 *	−49.1 *	1.2	3.5 **	1.1	2.4 *
South Rockies— U N = 1	−13.3	−12.9 *	−82.3	−79.1 *	−20.6 ****	21.7 ****	0.5	0.3
West Interior— M N = 6	4.9	7.4	−49.3	−71.0	−29.0 ****	−20.4 ****	0.2	1.3
West Interior—L N = 5	2.7	−3.4	54.0 **	19.4	0.5	−9.6	1.6	−0.3
West Interior— U N = 2	−4.5	−9.1 **	116.6 **	15.9	8.6	0.04	0.1	2.1
Wasatch Uinta—L N = 3	2.7	0.2	38.6	−2.1	−4.1	−7.8	−1.2	0.9
Wasatch Uinta—U N = 4	3.3	−4.0	14.4	3.1	2.3	−1.6	−2.5	4.4
AZ NM—H	71.8	59.3	−86.5 **	−63.8 ***	−31.4 ****	−9.0	0.7	2.3

N =2									
AZ NM—M Single Site	53.2	19.3	−94.1 *	−100.1	−20.5 *	−22.6 ***	−2.0	0.4	
AZ NM—L N = 6	3.8	4.1	−51.1 ****	−27.3 ***	−7.8 *	−1.9	−0.9	−1.3	
AZ NM—U N = 5	−5.7	−1.4	−95.1 ***	−63.7 ***	−20.3 ****	−17.9 ****	2.0 **	1.3 *	

**Table S3.** Normalized change values for micro-meteorological variables, including precipitation, temperature, soil moisture, and solar radiation at 78 SNOTEL stations located in burned forests for 5-years (5 Yrs) and 10-years (10 Yrs) following fire. (\*\*\*\*  $p$ -value < 0.001, \*\*\*  $p$ -value < 0.01, \*\*  $p$ -value < 0.05, \*  $p$ -value < 0.1).

Region	Δ Precipitation (mm)		Δ Temperature (°C)		Δ Soil Moisture 2 in. (%)		Δ Soil Moisture 8 in. (%)		Δ Soil Moisture 20 in. (%)		Δ Solar Radiation (W m <sup>−2</sup> )	
	5 Yrs	10 Yrs	5 Yrs	10 Yrs	5 Yrs	10 Yrs	5 Yrs	10 Yrs	5 Yrs	10 Yrs	5 Ys	10 Ys
West	−0.070	−0.063	0.433 ****	0.228 **	−4.484	−7.324 **	−4.481	−7.612 **	−7.500	−19.112 ***	−1.316 *	1121.481 ****
Alaska	−0.488 ****	−0.348 ****	−5.970 **	−2.581 **								
AZ NM	−0.202 *	−0.242 ****	1.252 ****	−1.784 **								
Cascades	−0.058	−162 *	0.492 *	0.6312 ****								
Northern Rockies	0.049 *	0.031	0.442 ***	1.089 ****								
Middle Rockies	−0.126	−0.056	−0.540 ****	−0.577 ****								
Southern Rockies	−0.293 **	−0.19 *	2.906 ****	3.209 ****								
Western In- terior	0.148 ***	0.069 **	0.838 ****	0.770 ****								
Wasatch Uinta	−0.006 *	−0.0680	−1.08 ****	−0.786 ****								



**Figure S1.** Forest fires decrease snow-water storage and advance snowmelt across the West. The annual mean for each year since fire (fire age) for the four pre- and post-fire snow accumulation and snowmelt metrics shown for all 78 burned SNOTEL sites. Standard error shown in error bars. Five year pre- and post-fire averages are shown as dotted line. Ten year pre- and post-fire averages are shown as solid grey line. Snow metrics include (a) peak snow water equivalent (Peak SWE, mm), (b) peak SWE date (PSD, date), (c) snow disappearance date (SDD, date), and (d) snowmelt rate (SMR, mm/melt days). Subset plots show a box plot for pre- and post-fire median snow metrics and mean snow metrics as black x. Significance of the difference between the pre- and post-fire snow metrics for all burned SNOTEL sites across the west and Alaska are shown as asterixis.