

Table S1. Tree-ring chronologies used in the study. Column headings are defined at the end of the table.

N	rwI	Species	Site Name	Lat	Lon	ElevM	First	Last	Type	Source	31-site
1	ca677	PIJE	Lemon Canyon Update	39.57	-120.28	1688	1415	2010	R	ITRDB	Yes
2	LEM	PIJE	Lemon Canyon Road	39.56	-120.25	2015	1541	2020	R	Biondi	Yes
3	ca632	JUGR	Sardine Point	39.55	-120.2	2268	1010	1999	R	ITRDB	Yes
4	ca631	JUGR	Jackson Meadow Res.	39.52	-120.55	1921	930	1999	R	ITRDB	Yes
5	CPR	PIPO	Rose Peak	39.46	-119.95	2507	1474	2020	R	Biondi	Yes
6	ca691	ABMA	Carpenter Ridge Fir	39.42	-120.31	2478	1540	2015	R	ITRDB	Yes*
7	ca692	TSME	Carpenter Ridge Hemlock	39.42	-120.31	2478	1615	2015	R	ITRDB	Yes*
8	IVJ	JUGR	Incline Village Juniper	39.28	-119.96	2563	1142	2000	R	Taylor	Yes
9	IVP	PIJE	Incline Village Pine	39.27	-119.96	2332	1305	2000	R	Taylor	Yes*
10	ca698	JUGR	Rocky Rdge	39.25	-120.35	1809	1600	2014	R	ITRDB	No
11	LTV	PIJE	Little Valley	39.25	-119.87	2006	1418	2020	R	Biondi	Yes
12	SSP	PIJE	Shakespeare Point	39.08	-119.94	2132	1190	1999	R	Taylor	Yes
13	GMH	TSME	Genoa Peak	39.04	-119.88	2728	1349	2000	R	Taylor	Yes
14	BLJP	PIJE	D. L. Bliss Jeffrey Pine	38.99	-120.11	2004	1306	2000	R	Taylor	Yes
15	BLSP	PILA	D. L. Bliss Sugar Pine	38.99	-120.11	2004	1398	2000	R	Taylor	Yes
16	ca630	JUGR	Carson Pass	38.70	-119.99	2591	-420	1999	R	ITRDB	Yes
17	LUR	PIJE	Luther Pass	38.80	-119.99	2416	1466	2020	R	Biondi	Yes
18	DGSa	JUGR	DGS	38.35	-119.38	2370	-300	2001	R	Biondi	Yes
19	ca678	PIJE	Log Cabin Mine Update	37.95	-119.15	2499	1304	2010	R	ITRDB	Yes
20	NOD	PIPO	NOD	37.46	-119.33	1539	1539	2002	R	Biondi	Yes
21	KAIM	JUGR	Kaiser Pass Merged	37.31	-119.11	2730	1140	2011	R	Meko	Yes
22	LEM-e	PIJE	Lemon Canyon Road	39.56	-120.25	2015	1541	2020	E	Biondi	Yes
23	CPR-e	PIPO	Rose Peak	39.46	-119.95	2507	1474	2020	E	Biondi	Yes
24	ca691-e	ABMA	Carpenter Ridge Fir	39.42	-120.31	2478	1540	2015	E	ITRDB	No
25	ca692-e	TSME	Carpenter Ridge Hemlock	39.42	-120.31	2478	1670	2015	E	ITRDB	No
26	LTV-e	PIJE	Little Valley	39.25	-119.87	2006	1418	2020	E	Biondi	Yes
27	LUR-e	PIJE	Luther Pass	38.80	-119.99	2416	1466	2020	E	Biondi	Yes
28	LEM-l	PIJE	Lemon Canyon Road	39.56	-120.25	2015	1541	2020	L	Biondi	Yes
29	CPR-l	PIPO	Rose Peak	39.46	-119.95	2507	1474	2020	L	Biondi	Yes*
30	ca691-l	ABMA	Carpenter Ridge Fir	39.42	-120.31	2478	1540	2015	L	ITRDB	No
31	ca692-l	TSME	Carpenter Ridge Hemlock	39.42	-120.31	2478	1670	2015	L	ITRDB	No

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32	LTV-I	PIJE	Little Valley	39.25	-119.87	2006	1418	2020	L	Biondi	Yes*
33	LUR-I	PIJE	Luther Pass	38.80	-119.99	2416	1466	2020	L	Biondi	Yes
34	LEM-b	PIJE	Lemon Canyon Road	39.56	-120.25	2015	1541	2020	B	Biondi	No
35	CPR-b	PIPO	Rose Peak	39.46	-119.95	2507	1474	2020	B	Biondi	Yes
36	LTV-b	PIJE	Little Valley	39.25	-119.87	2006	1418	2020	B	Biondi	Yes*
37	LUR-b	PIJE	Luther Pass	38.80	-119.99	2416	1466	2020	B	Biondi	Yes

N	Site number for cross-reference to this table
rwl	Name if source data storage file before standardization of ring-width or blue intensity (e.g., ca677.rwl); International Tree-Ring Data Bank (ITRDB) files begin with "ca" (California) or "nv" (Nevada)
Species	<i>Pinus jeffreyi</i> (PIJE), <i>Juniperus grandis</i> (JUGR), <i>Pinus ponderosa</i> (PIPO), <i>Abies magnifica</i> (ABMA), <i>Tsuga mertensiana</i> (TSME), <i>Pinus lambertiana</i> (PILA),
Site Name	Descriptive name of tree-ring site
Lat, Lon	Latitude and longitude of site, in decimal degrees
ElevM	Elevation of site (meters)
First Last	First and last years of measurements in rwl file; usable data may be shorter, depending on number of cores and expressed population signal, or EPS (see column "31-site")
Type	Type of tree-ring measurement: total ring width (R), earlywood width (E), latewood width (L) or delta blue intensity (B)
Source	Source of tree-ring measurements in rwl file: International Tree-Ring Data Bank (ITRDB), co-authors of paper (Franco Biondi, Alan Taylor, Dave Meko)
31-site	Thirty-one of the 37 chronologies satisfy the screening criterion of having a combination of at least 5 cores and EPS>0.85 by the year 1685 (target reconstruction period is 1685-1999). Only those chronologies marked "Yes" are considered for the analyses in this paper. Asterisk marks chronology included in the network with at least 5 cores and a relaxed threshold of EPS>0.75 by year 1685

Table S2. Global Historical Climate Network (GHCN), version 4) temperature and precipitation stations whose monthly data were used in interpolating 20 points in Truckee Carson River Basin. A list of the 32 temperature stations is followed by a list of the 73 precipitation stations. Last two columns are first (Go) and last (End) year with any monthly data. Precipitation version 4 data was “beta” at time of study.

Temperature Stations

N	GHCN Id	Latitude	Longitude	El (m)	Station Name	Go	End
1	USC00040161	41.4900	-120.5436	1334.4	ALTURAS	1905	2007
2	USC00040383	38.9072	-121.0839	393.8	AUBURN	1905	2016
3	USC00040931	39.3886	-120.0936	1699.3	BOCA	1936	2021
4	USC00041277	38.2769	-120.3114	1431.0	CALAVERAS_BIG_TREES	1929	2021
5	USC00041497	40.1706	-121.0886	1389.9	CANYON_DAM	1914	2020
6	USC00041912	39.0911	-120.9481	725.4	COLFAX	1870	2021
7	USC00042334	39.3000	-120.8500	1129.0	DEER_CREEK_PH	1907	1970
8	USC00042389	37.5667	-120.7833	43.0	DENAIR_3_NNE	1899	1984
9	USC00042728	38.3306	-120.6706	217.9	ELECTRA_P_H	1905	1994
10	USC00043939	37.9614	-119.7831	1179.6	HETCH_HETCHY	1910	2021
11	USC00044713	39.3183	-120.6392	1571.5	LAKE_SPAULDING	1907	2002
12	USC00045032	38.1061	-121.2878	12.2	LODI	1882	2013
13	USC00046960	38.6956	-120.8244	563.9	PLACERVILLE	1890	2010
14	USC00047085	39.8053	-120.4719	1478.3	PORTOLA	1915	2021
15	USC00047516	38.8000	-121.2333	75.9	ROCKLIN	1904	1976
16	USC00048218	39.5833	-120.3706	1516.4	SIERRAVILLE_RS	1909	2015
17	USC00048758	39.1678	-120.1428	1898.9	TAHOE_CITY	1909	2021
18	USC00048928	38.4461	-120.4992	717.8	TIGER_CREEK_PH	1907	1998
19	USC00049043	39.3331	-120.1730	1774.9	TRUCKEE_RS	1904	2009
20	USC00049775	38.7833	-119.8000	1722.1	WOODFORDS	1937	1990
21	USC00049855	37.7500	-119.5897	1224.7	YOSEMITE_PARK_HQ	1906	2021
22	USC00261485	39.1253	-119.7678	1451.2	CARSON_CITY	1893	2021
23	USC00262780	39.4572	-118.7811	1208.5	FALLON_EXP_STN	1889	2021
24	USC00264349	39.4689	-119.0644	1270.1	LAHONTAN_DAM	1911	2021
25	USC00264698	40.1906	-118.4767	1211.6	LOVELOCK	1891	2021
26	USC00265191	38.9547	-119.7758	1435.3	MINDEN	1906	2021
27	USC00266782	39.5333	-119.8167	1369.5	RENO_WBO	1870	1994
28	USC00267192	40.4661	-118.3047	1260.3	RYE_PATCH_DAM	1935	2021
29	USC00269229	38.9992	-119.1575	1335.0	YERINGTON	1894	2021
30	USW00023185	39.4839	-119.7711	1344.2	RENO_TAHOE_INTL_AP	1888	2021
31	USW00023258	37.6242	-120.9506	22.3	MODESTO_CITY_CO_AP	1927	2021
32	USW00023271	38.5556	-121.4169	11.6	SACRAMENTO_5_ESE	1853	2021

Precipitation Stations

N	GHCN Id	Latitude	Longitude	El (m)	St	Station Name	WMO id	Go	End
1	USC00040029	41.1936	-120.9447	1278.6	CA	ADIN RS	99999	1894	2022
2	USC00040161	41.4900	-120.5436	1334.4	CA	ALTURAS	99999	1905	2018
3	USC00040383	38.9072	-121.0839	393.8	CA	AUBURN	99999	1905	2021
4	USC00040931	39.3886	-120.0936	1699.3	CA	BOCA	99999	1906	2022
5	USC00041018	39.4539	-120.6556	1641.3	CA	BOWMAN DAM	99999	1896	2021
6	USC00041130	39.6950	-121.3453	1085.1	CA	BRUSH CREEK RS	99999	1937	1983
7	USC00041277	38.2769	-120.3114	1431.0	CA	CALAVERAS BIG TREES	99999	1929	2022
8	USC00041428	38.2486	-120.8433	200.6	CA	CAMP PARDEE	99999	1926	2022
9	USC00041462	39.4500	-121.0500	839.7	CA	CAMPTONVILLE RS	99999	1910	1973
10	USC00041497	40.1706	-121.0886	1389.9	CA	CANYON DAM	99999	1914	2021
11	USC00041614	41.5300	-120.1792	1428.9	CA	CEDARVILLE	99999	1894	2022
12	USC00041653	39.4833	-121.2167	783.3	CA	CHALLENGE RS	99999	1937	1994
13	USC00041700	40.3033	-121.2422	1380.7	CA	CHESTER	99999	1910	2022
14	USC00041912	39.0911	-120.9481	725.4	CA	COLFAX	99999	1870	2022
15	USC00041916	39.3308	-121.1922	181.4	CA	COLGATE POWERHOUSE	99999	1906	2022
16	USC00042334	39.3000	-120.8500	1129.0	CA	DEER CREEK PH	99999	1907	1970
17	USC00042389	37.5667	-120.7833	43.0	CA	DENAIR 3 NNE	99999	1899	1984
18	USC00042458	39.3333	-121.2000	473.0	CA	DOBBINS COLGATE FOREBA	99999	1903	1970
19	USC00042500	39.5633	-120.8239	888.5	CA	DOWNIEVILLE	99999	1908	2022
20	USC00042504	40.0267	-120.1056	1308.5	CA	DOYLE	99999	1923	2017
21	USC00042539	37.7500	-120.1000	915.0	CA	DUDLEYS	99999	1908	1976
22	USC00042728	38.3306	-120.6706	217.9	CA	ELECTRA P H	99999	1903	1997
23	USC00042760	38.2333	-121.2000	28.0	CA	ELLIOTT	99999	1926	1993
24	USC00043134	39.0100	-120.8456	919.0	CA	FORESTHILL RS	99999	1937	2021
25	USC00043491	39.1650	-120.8567	1011.9	CA	GOLD RUN 2 SW	99999	1905	2022
26	USC00043621	40.1408	-120.9506	1094.2	CA	GREENVILLE	99999	1894	2008
27	USC00043939	37.9614	-119.7831	1179.6	CA	HETCH HETCHY	99999	1910	2022
28	USC00044288	39.1181	-120.8406	944.9	CA	IOWA HILL	99999	1893	2007
29	USC00044713	39.3183	-120.6392	1571.5	CA	LAKE SPAULDING	99999	1895	2003
30	USC00045032	38.1061	-121.2878	12.2	CA	LODI	99999	1882	2013
31	USC00045346	37.4833	-119.9667	613.0	CA	MARIPOSA	99999	1893	1984
32	USC00046136	39.2467	-121.0008	847.6	CA	NEVADA CITY	99999	1893	2022
33	USC00046597	38.7583	-120.5031	1051.6	CA	PACIFIC HOUSE	99999	1941	2022
34	USC00046960	38.6956	-120.8244	563.9	CA	PLACERVILLE	99999	1900	2010
35	USC00047085	39.8053	-120.4719	1478.3	CA	PORTOLA	99999	1915	2022
36	USC00047195	39.9367	-120.9475	1042.4	CA	QUINCY	99999	1895	2022

Supplemental Material file TableS2.pdf

37	USC00047370	38.6944	-121.1611	89.9	CA	REPRESA	99999	1893	2011
38	USC00047516	38.8000	-121.2333	75.9	CA	ROCKLIN	99999	1904	1976
39	USC00048173	38.6667	-120.9167	420.9	CA	SHINGLE SPRINGS	99999	1906	1972
40	USC00048218	39.5833	-120.3706	1516.4	CA	SIERRAVILLE RS	99999	1909	2022
41	USC00048353	37.9672	-120.3872	510.5	CA	SONORA	99999	1905	2022
42	USC00048380	37.5122	-119.6331	1538.3	CA	SO ENTRANCE YOSEMITE NP	99999	1941	2022
43	USC00048560	37.9994	-121.3178	3.7	CA	STOCKTON FIRE STN 4	99999	1908	2010
44	USC00048702	40.4167	-120.6631	1283.8	CA	SUSANVILLE 2SW	99999	1885	2022
45	USC00048758	39.1678	-120.1428	1898.9	CA	TAHOE CITY	99999	1903	2022
46	USC00048928	38.4461	-120.4992	717.8	CA	TIGER CREEK PH	99999	1906	1998
47	USC00049043	39.3331	-120.1730	1774.9	CA	TRUCKEE RS	99999	1904	2009
48	USC00049073	37.5019	-120.8456	31.4	CA	TURLOCK #2	99999	1893	2022
49	USC00049105	38.7086	-120.0403	2438.4	CA	TWIN LAKES	99999	1919	2000
50	USC00049418	38.2000	-120.9667	100.9	CA	WALLACE	99999	1926	1977
51	USC00049775	38.7833	-119.8000	1722.1	CA	WOODFORDS	99999	1909	1990
52	USC00049855	37.7503	-119.5897	1224.7	CA	YOSEMITE PARK HQ	99999	1904	2022
53	USC00260507	39.4931	-117.0675	2066.5	NV	AUSTIN #2	99999	1888	2022
54	USC00261485	39.1253	-119.7678	1451.2	NV	CARSON CITY	99999	1893	2022
55	USC00262780	39.4572	-118.7811	1208.5	NV	FALLON EXP STN	99999	1889	2022
56	USC00263245	40.9567	-117.4922	1339.3	NV	GOLCONDA	99999	1878	2008
57	USC00263285	37.7081	-117.2331	1734.3	NV	GOLDFIELD	99999	1906	2009
58	USC00263957	40.6564	-118.1631	1298.4	NV	IMLAY	99999	1914	2022
59	USC00264349	39.4689	-119.0644	1270.1	NV	LAHONTAN DAM	99999	1911	2021
60	USC00264698	40.1700	-118.4775	1211.0	NV	LOVELOCK	99999	1888	2022
61	USC00265168	38.3878	-118.1092	1396.0	NV	MINA	99999	1896	2022
62	USC00265191	38.9547	-119.7758	1435.3	NV	MINDEN	99999	1906	2022
63	USC00265818	41.5683	-117.8389	1280.2	NV	OROVADA 3 W	99999	1911	2022
64	USC00266005	41.5022	-117.5478	1389.9	NV	PARADISE VALLEY 1 NW	99999	1894	2010
65	USC00267192	40.4661	-118.3047	1260.3	NV	RYE PATCH DAM	99999	1935	2022
66	USC00267261	40.3167	-119.8000	1189.9	NV	SAND PASS	99999	1913	1971
67	USC00269229	38.9992	-119.1575	1335.0	NV	YERINGTON	99999	1894	2022
68	USW00023157	37.3711	-118.3581	1250.3	CA	BISHOP AP	72480	1895	2022
69	USW00023185	39.4839	-119.7711	1344.2	NV	RENO TAHOE INTL AP	72488	1870	2022
70	USW00023225	39.2775	-120.7103	1608.1	CA	BLUE CANYON AP	99999	1940	2022
71	USW00023258	37.6242	-120.9506	22.3	CA	MODESTO CITY CO AP	99999	1906	2022
72	USW00023271	38.5556	-121.4169	11.6	CA	SACRAMENTO 5 ESE	99999	1877	2022
73	USW00024128	40.9017	-117.8081	1309.4	NV	WINNEMUCCA MUNI AP	72583	1870	2022

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Table S3. Coordinates of twenty points for water balance modeling.

Id	Lat	Lon	Elev (m)	Nearby	Elev Class
1	39.432	-120.3665	2390	Ridgeline 0.2 km W of Mt Lola	H
2	39.320	-119.9064	2653	1.2 km E of Tamarack Peak, 0.2 km W of Mt Rose Highway	H
3	39.202	-120.3033	2372	0.4 km NW of Needle Peak	H
4	38.906	-120.1335	2519	3 km SW of Emerald Bay	H
5	39.429	-120.2821	2193	2 km SE of Independence Lake	M
6	39.265	-119.9555	2207	Incline Village, 2.6 km N of shore of Lake Tahoe	M
7	38.983	-120.1247	2190	1 km NW of DL Bliss State Park	M
8	39.400	-120.1895	1894	7 km W of Boca Reservoir	M
9	39.207	-120.0081	1900	1.6 km off N shore of Lake Tahoe, near Speedboat Beach	M
10	38.958	-120.0412	1900	2 km off S shore of L Tahoe, nr Camp Richardson	M
11	39.433	-120.0255	2000	Gage at Farad (elev of gage itself 1570 m)	M
12	39.529	-119.8220	1414	Reno, I80 and Keystone Avenue	L
13	38.745	-119.9834	2515	1.4 km N of Stevens Peak	H
14	38.594	-119.8220	2519	1.2 km SE of Raymond Peak	H
15	38.430	-119.6508	2778	10 km N of Sonora Pass	H
16	38.765	-119.8398	2223	1.7 km W of Alpine Village	M
17	38.673	-119.8460	2177	2.6 km N of Thornburg Peak	M
18	38.549	-119.6627	2336	8 km E of Highland Peak	M
19	38.695	-119.7732	1886	Markleeville	M
20	38.936	-119.7038	1505	3 km E of Gardnerville	L

Id	Identification number of water balance modeling point
Lat, Lon	Latitude and longitude in decimal degrees
Elev (m)	Elevation (meters) of point as determined from PRISM explorer (entering the lat and lon of the point and having PRISM return the corresponding elevation
Nearby	Nearby landscape feature for ease of locating point quickly on map
Elev Class	Points are classified roughly as high (H), middle (M) or low (L) elevation

Table S4. Weights of Gaussian filter used to smooth time series plotted in Fig. 8 of main paper

0.007120023714
0.0157034298
0.03066616223
0.05302445026
0.08117919766
0.1100436961
0.1320801087
0.1403658631
0.1320801087
0.1100436961
0.08117919766
0.05302445026
0.03066616223
0.0157034298
0.007120023714

Table S5. Statistics of single-site reconstruction (SSR) models at point 7 not rejected for reconstruction of runoff and seasonal climate variables at Point 7. A) Direct runoff, B) Cool-season-total precipitation, C) Warm-season-total precipitation, D) Cool-season-average temperature, E) Warm-season-average temperature. Columns defined as follows:

1. N1 = sequential number of accepted SSR in this table.
2. N2 = cross-reference of chronology to tree-ring site information table (Table S1)
3. Site = site code of tree-ring chronology. Endings [.e, .l, .b] refer to earlywood width, latewood width and delta blue intensity. No ending means chronology is total-width
4. Goc = starting year of calibration period
5. Endc = ending year of calibration period
6. Model = lags on the chronology in the final stepwise model, and order of entry. From left to right, digits are lags -2 to +2 years from the year of the predictand. A 0 means lag not in model. Non-zero number gives the order in which a lag entered the model. For example, in Fig. S5A, site #16 has Model =[43102], indicating 4 predictors in the model, with lag 0 the first to enter.
7. Sign = sign of regression coefficient of the predictor in the corresponding column of “Model” For example, in Fig. S5A, site #16 has Sign = [NPP0P], meaning that lag-0 predictor entered with a positive (P) sign on the coefficient, and that the 4th variable to enter, lag t-2, entered with a negative sign.
8. R2a = calibration adjusted R-squared of model
9. pF = p-value of overall F statistic of regression. Test of null hypothesis that true values of all coefficient is zero. A significant model is indicated by p-value<0.05
10. REcv = cross-validation reduction of error (RE) statistic
11. REa = RE statistic for calibration on first half period Goc-Endc and validation on second half
12. REb = RE statistic for calibration on second half period Goc-Endc and validation on first half
13. Refit = whether the final listed calibration period (Goc-Endc) reflects re-fitting of model because positive lags not included in model (otherwise, depending on ending year of chronology, might not be able to use years 1998 and 1999 in calibration.
14. Gor = first year of single-site reconstruction
15. Endr = last year of single-site reconstruction
16. Reject = whether SSR rejected (see main paper). This table includes just the accepted SSR (of 31 tried) and so all entries are “FALSE”

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Table S5A - Statistics of screened single site reconstruction (SSR) models for runoff (RO)															

N1	N2	Site	Goc	Endc	Model	Sign	R2a	pF	REcv	REa	REb	Refit	Gor	Endr	Reject
1	1	ca677	1939	1999	00102	00P0P	0.59	1.6E-12	0.58	0.49	0.40	FALSE	1685	2008	FALSE
2	2	LEM	1939	1999	00100	00P00	0.32	1.3E-06	0.31	0.26	0.06	FALSE	1685	2020	FALSE
3	3	ca632	1939	1999	00100	00P00	0.08	0.013	0.08	0.03	0.17	TRUE	1685	1999	FALSE
4	5	CPR	1939	1999	00120	00PP0	0.12	0.0094	0.03	0.16	0.00	FALSE	1685	2019	FALSE
5	6	ca691	1939	1999	00210	00PP0	0.19	0.00072	0.19	0.21	0.06	FALSE	1685	2014	FALSE
6	7	ca692	1939	1999	00010	000P0	0.36	2.3E-07	0.33	0.41	0.07	FALSE	1685	2014	FALSE
7	9	IVP	1939	1999	00100	00P00	0.05	0.043	0.02	0.05	0.08	TRUE	1685	2000	FALSE
8	12	SSP	1939	1999	20100	POP00	0.53	9.4E-11	0.53	0.59	0.45	TRUE	1687	1999	FALSE
9	13	GMH	1939	1998	00201	00NON	0.13	0.0068	0.14	0.18	0.04	FALSE	1685	1998	FALSE
10	15	BLSP	1939	1998	00001	0000N	0.06	0.035	0.04	0.02	0.13	FALSE	1685	1998	FALSE
11	18	DGSa	1939	1999	32100	PPP00	0.24	0.00032	0.22	0.16	0.33	FALSE	1687	2001	FALSE
12	19	ca678	1939	1999	00100	00P00	0.37	1.3E-07	0.37	0.36	0.39	FALSE	1685	2010	FALSE
13	21	KAIM	1939	1999	00100	00P00	0.11	0.0055	0.09	0.07	0.20	FALSE	1685	2011	FALSE
14	22	LEM.e	1939	1999	00100	00P00	0.29	4.8E-06	0.28	0.24	0.04	FALSE	1685	2020	FALSE
15	29	CPR.1	1939	1999	20100	POP00	0.20	0.00049	0.21	0.28	0.05	TRUE	1687	2020	FALSE
16	32	LTV.1	1939	1999	00100	00P00	0.08	0.014	0.07	0.09	0.09	FALSE	1685	2020	FALSE
17	36	LTV.b	1939	1999	32104	PPP0N	0.21	0.0015	0.15	0.17	0.23	FALSE	1687	2017	FALSE

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Table S5B - Statistics of screened single site reconstruction (SSR) models for cool-season P															
N1	N2	Site	Goc	Endc	Model	Sign	R2a	pF	REcv	REa	REb	Refit	Gor	Endr	Reject
1	1	ca677	1939	1999	00100	00P00	0.50	1.5E-10	0.50	0.41	0.42	TRUE	1685	2010	FALSE
2	2	LEM	1939	1999	00100	00P00	0.28	7.6E-06	0.28	0.27	0.06	FALSE	1685	2020	FALSE
3	3	ca632	1939	1999	20100	P0P00	0.13	0.007	0.13	0.07	0.24	TRUE	1687	1999	FALSE
4	5	CPR	1939	1999	00100	00P00	0.07	0.023	0.05	0.09	0.07	TRUE	1685	2020	FALSE
5	6	ca691	1939	1999	00010	000P0	0.14	0.0018	0.14	0.18	0.08	FALSE	1685	2014	FALSE
6	7	ca692	1939	1999	20010	N00P0	0.38	4E-07	0.36	0.34	0.03	FALSE	1687	2014	FALSE
7	12	SSP	1939	1999	20100	P0P00	0.47	4.1E-09	0.48	0.54	0.40	TRUE	1687	1999	FALSE
8	13	GMH	1939	1998	00102	00N0N	0.19	0.00083	0.21	0.25	0.12	TRUE	1685	1998	FALSE
9	18	DGSa	1939	1999	00100	00P00	0.24	3.3E-05	0.22	0.15	0.37	FALSE	1685	2001	FALSE
10	19	ca678	1939	1999	00100	00P00	0.36	2.4E-07	0.37	0.36	0.37	FALSE	1685	2010	FALSE
11	21	KAIM	1939	1999	20100	P0P00	0.21	0.00046	0.20	0.05	0.36	FALSE	1687	2011	FALSE
12	22	LEM.e	1939	1999	00100	00P00	0.24	3.9E-05	0.24	0.25	0.02	FALSE	1685	2020	FALSE
13	28	LEM.1	1939	1999	00100	00P00	0.39	4.9E-08	0.36	0.35	0.10	FALSE	1685	2020	FALSE
14	29	CPR.1	1939	1999	20100	P0P00	0.19	0.00078	0.22	0.24	0.14	FALSE	1687	2020	FALSE
15	32	LTV.1	1939	1999	00100	00P00	0.12	0.0042	0.10	0.07	0.20	FALSE	1685	2020	FALSE
16	33	LUR.1	1939	1999	03210	0PPP0	0.19	0.002	0.19	0.20	0.07	FALSE	1686	2019	FALSE
17	36	LTV.b	1939	1999	00100	00P00	0.14	0.0016	0.13	0.12	0.19	TRUE	1685	2019	FALSE

Table S5C - Statistics of screened single site reconstruction (SSR) models for warm-season P

N1	N2	Site	Goc	Endc	Model	Sign	R2a	pF	REcv	REa	REb	Refit	Gor	Endr	Reject
1	2	LEM	1939	1999	01200	ONP00	0.07	0.045	0.04	0.12	0.03	FALSE	1686	2020	FALSE
2	5	CPR	1939	1999	00010	000P0	0.06	0.036	0.06	0.02	0.09	FALSE	1685	2019	FALSE
3	6	ca691	1939	1999	00010	000P0	0.17	0.00065	0.17	0.09	0.21	TRUE	1685	2014	FALSE
4	11	LTV	1939	1999	00100	00P00	0.07	0.019	0.07	0.08	0.03	TRUE	1685	2020	FALSE
5	12	SSP	1939	1999	01200	ONP00	0.07	0.05	0.06	0.11	0.02	TRUE	1686	1999	FALSE
6	13	GMH	1939	1999	20010	P00P0	0.13	0.0056	0.10	0.05	0.11	TRUE	1687	1999	FALSE
7	18	DGSa	1939	1999	00100	00P00	0.05	0.044	0.06	0.07	0.07	FALSE	1685	2001	FALSE
8	22	LEM.e	1939	1999	01200	ONP00	0.07	0.045	0.05	0.13	0.03	FALSE	1686	2020	FALSE
9	26	LTV.e	1939	1999	00100	00P00	0.05	0.047	0.04	0.03	0.03	TRUE	1685	2020	FALSE
10	27	LUR.e	1939	1999	40312	N0NPN	0.21	0.0014	0.16	0.21	0.08	FALSE	1687	2018	FALSE
11	29	CPR.1	1939	1999	02013	0N0PP	0.14	0.0089	0.11	0.09	0.11	FALSE	1686	2018	FALSE
12	32	LTV.1	1939	1999	00120	00PP0	0.11	0.013	0.10	0.16	0.01	FALSE	1685	2019	FALSE
13	35	CPR.b	1939	1999	00100	00N00	0.23	5.4E-05	0.21	0.26	0.24	TRUE	1685	2020	FALSE
14	37	LUR.b	1939	1999	02100	0NN00	0.23	0.00022	0.18	0.28	0.26	TRUE	1686	2020	FALSE

Table S5D - Statistics of screened single site reconstruction (SSR) models for cool-season T

N1	N2	Site	Goc	Endc	Model	Sign	R2a	pF	REcv	REa	REb	Refit	Gor	Endr	Reject
1	6	ca691	1939	1999	00010	000N0	0.09	0.013	0.08	0.12	0.08	FALSE	1685	2014	FALSE
2	8	IVJ	1939	1999	20100	P0P00	0.08	0.036	0.05	0.08	0.10	TRUE	1687	2000	FALSE
3	12	SSP	1939	1997	00012	000NP	0.14	0.0052	0.09	0.19	0.10	FALSE	1685	1997	FALSE
4	32	LTV.1	1939	1999	00001	0000P	0.09	0.012	0.07	0.13	0.02	FALSE	1685	2018	FALSE
5	35	CPR.b	1939	1999	00201	00P0N	0.13	0.006	0.07	0.12	0.12	FALSE	1685	2018	FALSE

Table S5E - Statistics of screened single site reconstruction (SSR) models for warm-season T

N1	N2	Site	Goc	Endc	Model	Sign	R2a	pF	REcv	REa	REb	Refit	Gor	Endr	Reject
1	1	ca677	1939	1999	00100	00N00	0.09	0.012	0.04	0.15	0.01	FALSE	1685	2010	FALSE
2	6	ca691	1939	1999	00010	000N0	0.20	0.00018	0.19	0.23	0.20	FALSE	1685	2014	FALSE
3	7	ca692	1939	1999	00010	000N0	0.32	1.3E-06	0.32	0.40	0.26	FALSE	1685	2014	FALSE
4	13	GMH	1939	1999	00210	00PNO	0.22	0.00026	0.20	0.28	0.15	TRUE	1685	1999	FALSE
5	17	LUR	1939	1999	00010	000N0	0.20	0.00021	0.18	0.28	0.04	FALSE	1685	2019	FALSE
6	19	ca678	1939	1999	00010	000N0	0.09	0.012	0.08	0.10	0.09	TRUE	1685	2009	FALSE
7	27	LUR.e	1939	1999	00012	000NP	0.20	0.00053	0.18	0.32	0.02	FALSE	1685	2018	FALSE
8	33	LUR.1	1939	1999	00010	000N0	0.11	0.0049	0.10	0.16	0.07	FALSE	1685	2019	FALSE
9	35	CPR.b	1939	1999	02100	0PP00	0.40	1.3E-07	0.40	0.41	0.34	TRUE	1686	2020	FALSE
10	37	LUR.b	1939	1999	00120	00PNO	0.18	0.0014	0.14	0.20	0.17	FALSE	1685	2019	FALSE

Table S6. Monthly point-7 total precipitation and average temperature. Data spatially interpolated from Global Historical Climate Network and scaled by PRISM data as described in main paper. Precipitation (mm) is followed by temperature (degrees Celsius)

Precipitation (mm)

Year	Jan	Feb	Mar	Apr	May	June	July	August	September	October	November	December
1895	391.791	129.461	85.725	60.29	87.267	0.754	0	13.557	64.523	32.514	43.452	154.231
1896	408.323	39.055	212.793	266.661	119.967	2.529	21.256	43.325	47.435	30.015	256.562	115.545
1897	109.661	301.349	241.168	38.066	34.63	37.049	1.764	13.025	7.238	115.564	79.107	140.134
1898	75.907	164.565	87.704	55.765	59.294	28.496	0	7.267	16.761	53.874	119.251	68.032
1899	185.093	67.317	314.427	43.606	59.045	28.381	0.188	43.449	1.336	176.129	167.996	225.678
1900	85.301	75.81	134.682	199.049	50.772	23.355	3.303	3.853	27.851	143.548	250.797	99.73
1901	231.258	300.542	79.598	120.739	76.536	2.108	0	25.642	74.53	81.263	118.522	123.942
1902	46.976	300.975	180.8	73.849	32.637	7.225	1.482	14.254	6.185	63.755	131.261	135.284
1903	287.654	104.299	228.448	74.153	20.891	6.628	0	1.984	0	29.199	268.435	46.569
1904	68.114	503.802	350.107	75.571	18.046	0	0.238	12.488	89.066	143.991	26.357	123.717
1905	69.029	111.589	171.979	114.689	68.946	3.459	0	8.165	8.792	6.817	103.002	66.518
1906	373.512	156.412	250.808	83.032	139.434	26.918	5.572	10.654	8.272	9.995	111.266	341.212
1907	284.327	122.571	672.267	37.594	38.046	47.335	0.052	2.702	3.58	68.132	0	246.837
1908	101.781	132.427	109.909	18.707	77.723	14.805	9.341	3.324	15.448	80.288	59.246	77.679
1909	696.612	276.971	97.378	14.417	21.315	11.07	0	0.675	1.845	66.083	260.438	353.88
1910	223.626	110.103	72.044	24.06	2.28	0	26.878	0	25.886	8.352	59.753	158.21
1911	634.778	161.68	269.066	94.403	11.681	11.304	5.36	0	0.593	6.612	49.528	95.871
1912	85.854	16.92	131.75	83.51	95.657	18.663	17.753	0	61.082	17.853	76.944	64.59
1913	215.256	56.058	77.242	51.022	80.703	28.149	45.941	22.995	3.217	3.827	125.458	254.934
1914	638.578	229.154	31.531	131.448	17.491	31.163	0	6.277	4.031	44.636	24.687	129.068
1915	179.833	394.388	68.892	39.764	150.419	0	2.372	3.161	3.833	3.065	68.667	201.135
1916	611.104	139.335	120.214	14.848	16.745	0	0.468	5.497	29.581	97.586	65.921	181.893
1917	65.489	265.977	122.636	80.587	68.504	0.533	15.394	2.741	0.671	6.851	50.111	80.496
1918	49.217	359.281	312.298	36.294	8.321	12.239	0	2.207	151.948	86.867	99.648	58.626
1919	79.682	394.604	134.849	72.08	26.427	0	0	0.246	24.421	22.467	35.746	268.296
1920	30.434	84.226	222.179	113.96	0	76.774	2.419	22.324	18.612	160.206	177.695	221.942
1921	318.152	90.434	86.814	25.909	117.095	21.878	0	0.215	6.833	25.325	52.28	296.836
1922	125.772	394.095	154.998	47.348	49.412	37.463	13.378	3.12	1.29	34.098	134.27	346.408
1923	199.528	69.365	44.56	180.839	34.579	48.386	0.083	18.854	73.982	69.846	30.833	90.438
1924	82.063	52.843	114.773	53.227	0	0.043	0	0	13.287	130.174	128.96	157.692

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1925	61.103	279.768	98.597	119.741	53.64	38.203	18.525	37.132	45.975	48.396	85.254	60.105
1926	129.04	207.165	38.256	136.824	37.094	9.211	0.377	0	0.672	22.766	398.016	90.011
1927	137.355	266.38	111.702	162.508	36.287	21.158	5.012	1.668	7.454	115.74	161.841	89.573
1928	75.67	55.609	352.21	120.502	11.894	6.853	0	1.921	0.839	14.689	63.02	118.032
1929	72.45	123.023	132.25	118.351	1.118	91.15	2.757	4.384	4.293	6.585	8.736	270.301
1930	212.143	161.163	127.78	116.956	65.804	0	0	8.685	66.003	16.559	152.589	29.087
1931	125.705	94.195	102.382	163.267	48.97	40.334	0	2.929	26.969	44.601	104.091	359.513
1932	180.325	166.194	58.845	53.317	30.134	30.757	0.008	0	6.308	6.729	30.432	100.052
1933	247.839	47.344	130.136	25.086	84.12	11.582	0.142	11.201	4.704	132.35	13.08	282.361
1934	74.076	108.945	52.661	26.429	37.027	76.627	0	12.138	37.96	84.235	138.658	91.251
1935	166.796	71.512	166.387	318.433	11.284	0.883	1.137	14.537	0.243	53.614	85.323	111.273
1936	251.957	457.156	82.611	39.061	11.332	58.112	1.572	8.167	20.476	23.12	12.169	222.443
1937	186.547	308.833	81.723	71.253	4.889	25.696	18.683	0	1.307	40.793	120.301	338.639
1938	136.663	464.723	396.245	66.136	15.261	72.009	18.441	0.524	8.379	70.677	74.947	50.671
1939	151.182	105.763	111.851	46.506	59.281	7.01	0.253	1.043	83.729	77.169	17.586	54.254
1940	443.818	306.232	215.943	44.965	14.24	19.461	0	2.529	14.868	58.634	65.705	311.131
1941	145.23	165.552	93.874	133.842	30.014	42.798	0	7.098	3.363	98.58	60.921	408.999
1942	271.992	150.871	78.463	153.277	94.701	7.376	0	3.68	5.327	8.754	338.855	169.412
1943	400.245	108.065	253.774	74.624	20.544	17.676	9.906	0	0	38.152	34.762	98.591
1944	157.046	185.499	123.53	78.175	38.013	11.692	3.245	0	9.544	82.663	238.895	117.716
1945	64.411	263.837	173.772	39.393	116.547	53.658	12.739	7.809	1.055	256.352	148.517	332.647
1946	80.272	89.697	187.929	16.965	13.996	0.604	18.31	0	30.801	54.078	323.691	96.725
1947	70.494	101.245	148.646	44.9	17.868	13.348	0	3.912	3.575	137.604	38.887	35.123
1948	110.381	110.421	139.613	207.826	57.018	22.737	0	0.902	8.262	19.724	77.214	197.165
1949	113.966	122.883	155.074	22.014	140.238	3.834	0	15.238	1.918	22.516	119.74	76.727
1950	361.128	110.558	178.577	151.174	49.634	45.249	0	3.966	21.969	191.429	453.743	349.812
1951	181.005	99.497	69.701	126.819	51.898	21.23	0	9.994	17.44	115.788	154.866	360.59
1952	319.848	154.503	301.371	106.195	8.414	22.446	37.669	3.777	19.724	7.3	95.398	258.111
1953	181.403	44.288	108.864	159.71	110.995	45.088	2.585	32.133	3.161	39.757	72.248	76.896
1954	174.133	175.023	197.727	45.533	1.662	18.295	2.101	0	0	0.341	135.535	189.758
1955	141.862	95.845	61.012	106.531	44.981	11.579	3.602	0.332	39.308	13.092	112.235	786.858
1956	305.118	119.429	48.903	98.199	114.467	9.962	14.695	2.613	22.511	177.976	18.684	71.339
1957	181.456	173.953	133.088	77.311	129.238	2.877	6.357	0	18.879	70.453	102.528	172.853
1958	174.303	248.756	228.41	204.709	22.955	44.164	24.919	40.208	25.097	9.789	72.296	80.705
1959	165.756	240.125	52.896	21.278	80.955	2.098	0.957	8.194	64.912	0.688	15.035	63.21

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1960	143.408	254.11	139.753	31.972	16.305	1.22	18.18	0	10.442	22.831	169.97	93.492
1961	60.354	109.887	129.985	85.862	75.002	28.768	5.292	37.27	35.981	49.996	105.119	72.161
1962	101.201	441.424	183.288	31.923	82.454	9.294	9.541	6.096	3.288	240.92	55.118	95.976
1963	306.006	190.625	173.15	252.582	105.087	109.004	0	5.882	51.125	71.957	264.801	47.172
1964	141.428	34.855	111.394	65.47	131.008	30.568	3.279	2.185	1.003	23.958	159.196	652.558
1965	222.258	56.037	70.838	131.592	17.561	29.13	14.389	94.217	47.881	12.716	309.831	184.273
1966	73.292	71.131	66.471	41.772	35.764	6.346	0	1.259	15.549	2.972	197.729	268.799
1967	323.346	35.572	325.068	159.155	54.064	42.85	11.252	18.087	44.335	36.839	99.645	111.372
1968	147.374	136.84	131.769	23.193	76.478	13.747	0	24.633	11.41	40.539	152.545	234.894
1969	587.958	282.489	90.591	72.376	12.746	89.438	2.786	0	9.194	84.611	58.857	296.299
1970	410.106	103.454	76.022	61.889	3.378	76.294	0	0.381	5.882	30.394	333.558	265.858
1971	118.342	52.959	199.202	59.822	118.863	21.962	5.582	14.742	19.37	32.828	161.992	266.24
1972	83.022	81.355	51.72	117.182	24.677	45.328	0	11.457	52.321	123.427	143.298	161.603
1973	244.114	181.975	90.547	28.873	37.715	14.729	0.003	44.907	4.683	88.265	294.212	264.667
1974	149.454	66.606	232.603	82.59	5.828	2.306	47.571	9.996	0.178	61.417	85.891	114.191
1975	99.56	246.493	284.535	156.795	25.093	21.115	0	43.221	40.678	181.067	68.337	33.157
1976	50.107	126.257	90.27	24.098	9.286	6.343	18.718	48.72	61.486	46.142	33.114	31.195
1977	80.094	137.545	71.612	11.719	93.336	50.552	0	0.927	7.534	10.997	161.781	325.116
1978	232.917	173.116	135.074	74.194	28.085	13.449	0	7.057	43.994	14.071	91.923	124.211
1979	204.732	173.957	122.762	48.748	46.969	4.107	15.419	4.677	1.302	100.789	67.271	204.911
1980	397.969	337.111	119.049	108.323	49.904	11.628	12.953	8.238	22.969	31.63	46.751	103.994
1981	197.583	80.362	121.665	65.108	59.784	6.875	0	2.825	16.653	145.261	333.844	270.015
1982	292.609	177.597	241.489	244.807	14.602	56.57	0.303	9.244	153.229	218.227	262.565	203.065
1983	249.627	279.549	285.158	148.824	9.525	24.418	0	69.609	91.186	70.78	469.302	246.561
1984	49.608	145.723	97.148	58.103	15.141	58.467	12.883	5.604	19.851	116.623	282.917	52.914
1985	51.137	86.03	171.619	18.039	0	13.719	2.374	2.188	62.448	76.656	188.384	111.609
1986	130.281	659.773	182.588	55.469	21.214	10.018	26.793	2.454	66.018	5.426	25.438	39.969
1987	124.747	143.19	104.434	25.683	39.204	27.81	0.49	0.707	1.15	85.357	83.155	147.053
1988	113.469	33.129	43.248	68.574	26.481	33.685	3.71	2.442	3.207	4.184	249.43	150.618
1989	88.122	107.747	277.418	46.085	59.975	59.975	3.081	32.89	81.089	102.609	128.366	25.145
1990	116.032	111.518	54.163	53.996	59.195	13.761	18.608	22.404	33.663	14.911	48.458	74.553
1991	32.426	63.067	363.101	34.488	51.795	15.409	11.474	40.857	18.025	114.519	99.218	63.311
1992	51.888	137.823	92.531	18.268	8.137	57.363	16.411	18.874	16.004	103.838	21.783	321.283
1993	314.84	215.938	135.53	53.467	40.875	45.163	0	1.594	0	87.683	60.295	75.032
1994	72.667	183.454	52.719	51.884	88.744	0.143	0	0	27.274	48.872	263.725	99.434

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1995	400.507	52.626	536.465	153.542	173.108	57.079	2.59	0.263	0	2.577	27.495	256.147
1996	323.504	316.175	209.455	104.902	130.51	34.936	1.202	24.761	9.78	58.18	212.443	512.126
1997	497.405	55.262	43.345	47.609	15.532	79.646	0	0.655	19.098	39.391	126.62	104.022
1998	226.017	373.359	228.513	47.062	122.926	75.092	0.902	7.646	135.591	38.676	174.194	107.552
1999	237.104	324.261	102.834	113.19	18.148	23.645	1.634	27.036	4.482	54.677	75.545	44.091
2000	295.619	240.838	48.55	63.639	72.177	11.125	0	2.152	35.389	70.334	94.221	48.746
2001	85.683	124.208	77.272	148.263	5.191	1.733	8.852	0.746	18.004	24.021	190.947	255.853
2002	95.325	78.242	148.534	67.05	17.483	1.136	8.093	2.294	0	5.67	214.65	439.072
2003	57.907	71.973	91.345	217.205	31.751	15.778	1.929	51.116	20.129	8.139	91.947	249.819
2004	91.252	203.186	56.808	22.253	19.317	8.96	0	8.997	7.975	167.048	91.203	197.116
2005	231.14	112.249	206.952	80.549	131.736	46.08	2.681	11.387	21.974	36.723	80.38	622.806
2006	236.886	195.376	260.395	253.795	23.483	16.355	1.023	1.081	0.101	22.874	111.019	106.926
2007	73.247	217.011	61.134	67.76	21.381	7.715	0	3.781	40.893	52.996	33.699	130.968
2008	272.661	142.239	55.603	15.305	42.27	1.067	0	0.199	0	38.489	98.317	137.262
2009	110.561	128.54	203.147	34.988	106.492	29.854	0	2.675	0.767	151.372	42.004	167.119
2010	218.041	140.024	126.83	154.221	62.252	9.591	3.021	7.381	0.772	275.239	202.967	373.818
2011	43.72	197.126	386.708	71.522	85.672	98.872	2.606	0.757	20.428	67.057	44.339	14.077
2012	170.718	68.549	222.272	99.681	11.825	19.879	20.791	19.685	8.22	43.547	158.96	375.76
2013	49.992	33.008	79.562	31.277	72.918	25.055	2.045	6.321	30.036	29.813	35.639	61.271
2014	98.972	243.822	108.185	52.914	63.669	1.251	23.662	24.611	29.938	16.615	80.583	157.134
2015	32.178	198.808	40.021	113.568	71.71	52.71	26.358	4.342	2.511	85.272	139.582	231.587
2016	236.612	93.29	194.704	153.388	64.467	5.788	0	2.423	0.931	307.737	88.296	227.992
2017	603.605	530.131	178.054	202.638	43.964	14.278	0.836	25.251	60.797	26.878	299.634	28.366
2018	140.053	49.068	378.16	109.62	108.561	2.049	4.041	0.035	0	34.837	149.324	111.03
2019	253.823	518.417	181.555	62.105	126.232	12.732	0	0.401	36.789	4.846	58.75	261.283
2020	78.964	31	198.471	77.037	42.789	8.284	4.596	6.089	0	4.454	119.294	95.367
2021	154.558	87.214	75.524	29.677	27.264	2.891	3.906	0.261	7.501	339.268	58.126	409.213

Temperature (degrees C)

Year	Jan	Feb	Mar	Apr	May	June	July	August	September	October	November	December
1895	-3.037	-0.02	-0.319	3.125	6.387	11.753	13.997	14.244	8.77	8.153	1.528	-1.938
1896	1.184	-0.037	-0.2	-2.033	3.632	12.967	16.661	14.179	10.148	8.237	1.306	1.492
1897	-2.493	-4.309	-4.35	4.466	9.056	9.517	14.845	15.422	9.382	5.326	2.347	-1.413
1898	-6.042	-0.164	-1.991	5.075	4.492	10.925	15.843	15.572	10.966	5.725	2.919	-2.234

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1899	-0.408	-1.164	-1.404	3.783	3.806	11.967	15.212	11.913	13.83	5.492	3.802	-0.888
1900	1.873	0.337	3.064	1.851	7.275	12.296	15.607	12.001	8.406	7.011	4.309	0.418
1901	-1.366	-2.981	0.701	1.851	6.131	10.084	15.383	15.354	10.933	8.551	3.934	0.183
1902	-2.277	-0.078	-3.337	1.676	3.668	12.345	14.433	14.295	13.193	6.593	0.644	0.131
1903	-1.713	-7.822	-1.161	1.062	7.191	11.974	12.397	14.079	10.832	8.938	4.265	-0.379
1904	-1.792	-1.103	-0.479	2.295	8.343	12.297	14.434	15.79	12.297	7.218	3.93	-0.657
1905	0.535	-0.544	1.47	3.578	4.418	10.296	15.867	15.106	11.255	5.851	1.433	-2.731
1906	0.809	1.601	-0.092	2.87	4.967	9.116	17.012	15.68	11.377	7.943	1.374	0.256
1907	-2.555	2.97	-1.571	4.712	5.719	8.442	14.144	13.59	9.236	8.553	3.203	1.005
1908	-0.156	-1.282	0.683	4.66	4.127	9.591	17.051	15.009	11.342	4.913	2.825	-3.096
1909	0.36	-1.942	-1.098	3.892	5.336	11.525	13.873	14.87	11.645	6.936	2.961	-2.65
1910	-4.792	-2.898	3.592	6.129	8.833	10.837	15.944	14.936	11.707	8.263	4.6	1.064
1911	-1.033	-4.885	1.334	2.206	4.378	11.28	15.984	13.33	8.43	5.703	1.906	-2.869
1912	-0.226	0.294	-1.484	0.397	5.751	9.702	13.889	12.944	9.507	4.736	3.535	-1.149
1913	-3.789	-2.518	-0.425	2.708	7.117	9.311	13.952	15.203	12.635	7.604	3.006	-0.961
1914	-1.095	-1.815	2.948	3.489	7.725	9.688	14.956	15.903	10.765	7.14	4.139	-3.601
1915	-1.778	-1.558	1.951	4.262	4.784	9.92	13.898	15.841	11.381	9.312	2.851	-0.011
1916	-5.993	1.061	2.674	4.275	4.981	10.269	13.74	13.108	11.123	4.407	0.979	-2.739
1917	-5.831	-2.588	-3.281	1.281	3.951	11.137	17.233	16.921	12.82	10.412	4.428	2.898
1918	0.16	-1.567	-0.261	2.955	5.213	15.328	14.61	13.78	11.758	8.427	1.426	-1.563
1919	-1.031	-3.025	-1.643	3.675	9.836	11.073	16.921	16.25	11.391	4.148	1.318	-1.464
1920	0.597	-0.751	-1.19	1.858	7.106	10.558	14.126	15.642	11.228	3.907	1.893	-0.943
1921	-1.441	-0.402	2.031	2.005	5.295	11.542	15.777	15.195	11.294	9.142	4.123	0.607
1922	-6.2	-4.378	-1.936	0.246	6.461	12.867	17.015	14.371	13.542	7.037	-0.381	-0.457
1923	-2.225	-4.281	0.43	2.055	6.77	7.705	15.245	13.92	12.503	5.441	3.5	-1.893
1924	-3.792	1.465	-1.295	3.562	10.169	12.43	15.853	14.358	12.013	5.968	1.642	-2.886
1925	-0.758	0.177	1.688	4.091	8.248	11.366	16.828	13.994	8.933	5.647	0.841	-0.373
1926	-2.78	-0.992	3.021	6.522	7.647	14.796	16.179	15.129	10.015	7.529	4.935	-2.064
1927	-1.203	-0.949	0.483	2.384	5.815	11.919	15.846	14.216	9.663	7.598	4.005	-2.56
1928	-1.598	-1.469	2.47	2.586	10.627	11.39	16.177	15.124	12.432	6.822	2.146	-2.939
1929	-3.125	-3.969	0.409	0.246	7.901	9.897	16.665	17.49	11.061	8.124	1.958	3.015
1930	-4.69	0.583	0.771	4.708	4.749	12.489	16.311	14.942	10.903	5.734	1.242	-2.55
1931	-1.687	-0.075	1.821	4.989	10.017	11.777	18.994	18.125	10.815	7.879	-0.211	-3.79
1932	-4.509	-5.325	1.536	2.661	6.727	12.815	14.918	15.037	13.631	7.082	4.543	-4.604
1933	-4.021	-6.186	0.667	2.521	3.392	11.559	17.656	16.411	11.904	10.646	2.829	0.711

Sheet1

1934	0.657	1.101	6.068	7.058	9.312	10.527	15.582	17.062	12.543	8.271	3.589	-0.578
1935	-2.793	-0.485	-2.53	2.587	6.286	12.651	14.263	16.51	14.335	5.42	-0.245	-1.382
1936	-0.699	-2.317	1.18	4.246	7.97	11.685	17.356	16.214	11.127	7.818	2.001	-1.179
1937	-9.31	-2.361	0.708	2.279	8.691	11.283	16.582	15.931	13.13	7.792	3.615	0.886
1938	0.053	-3.62	-1.982	2.945	6.662	12.467	15.651	15.604	13.317	6.394	-0.198	0.307
1939	-0.584	-4.521	1.422	6.605	7.942	11.14	16.511	17.536	12.079	6.431	3.706	2.555
1940	-0.907	-0.003	1.884	3.654	9.418	14.608	14.704	16.772	10.553	8.183	1.453	0.552
1941	-0.105	0.462	1.181	1.549	7.574	10.392	16.32	14.264	9.079	5.323	3.46	-0.442
1942	-3.111	-3.37	-0.575	2.598	4.527	10.123	16.459	15.988	11.677	7.701	2.667	0.467
1943	-1.247	-0.549	1.18	4.986	6.989	8.052	15.295	12.987	13.95	7.295	2.835	-1.02
1944	-1.926	-2.432	-0.658	1.204	7.016	8.519	14.237	14.163	12.623	8.425	-0.112	-0.777
1945	-1.455	-0.491	-1.407	2.511	6.239	10.187	16.446	14.83	12.157	8.734	1.717	-1.181
1946	-1.762	-2.225	0.16	4.358	7.294	10.556	15.607	15.878	11.282	4.007	0.402	0.294
1947	-2.482	1.783	1.924	4.074	9.858	10.225	13.757	13.797	13.057	7.639	-0.111	-0.962
1948	0.854	-2.975	-1.991	1.4	4.965	10.662	14.03	13.169	11.65	7.149	1.178	-4.199
1949	-9.579	-4.924	-1.063	4.853	6.367	11.782	15.565	13.578	12.379	5.932	4.664	-1.786
1950	-4.278	0.041	-0.592	3.205	6.152	10.191	16.256	15.204	11.178	8.542	4.919	2.142
1951	-1.42	-0.811	-0.333	4.562	6.513	11.518	15.639	14.135	13.222	5.477	1.912	-2.869
1952	-4.979	-2.225	-4.226	3.262	7.383	8.963	15.548	14.49	12.328	10.183	-0.325	-1.253
1953	1.018	-1.343	-0.299	2.04	2.583	7.808	15.726	13.36	13.509	6.319	3.421	-0.653
1954	-0.789	0.228	-1.997	5.133	9.087	9.641	15.841	12.553	10.87	7.059	3.876	-1.971
1955	-5.34	-3.585	-1.126	-0.114	5.871	10.58	13.48	16.147	11.942	8.151	2.357	0.121
1956	-0.547	-5.305	0.097	2.2	6.307	10.587	14.489	12.606	12.446	5.248	0.952	-1.369
1957	-5.265	0.181	0.798	2.7	5.491	12.118	14.296	13.043	12.605	5.055	0.685	-0.017
1958	-1.474	0.834	-2.836	1.004	8.449	10.206	14.49	16.991	12.051	9.044	1.882	2.235
1959	0.579	-2.659	1.655	4.953	4.754	12.176	17.071	14.526	10.046	7.777	2.588	-2.224
1960	-3.837	-2.559	1.686	3.048	5.528	13.271	16.04	14.474	12.64	7.02	1.547	-1.344
1961	0.433	0.534	0.048	2.943	5.341	13.474	15.675	15.6	9.314	5.621	0.318	-1.677
1962	-3.927	-3.412	-2.75	4.482	4.557	10.977	14.042	13.88	12.677	7.195	3.764	0.587
1963	-2.397	3.175	-1.08	-1.001	7.298	8.711	13.029	13.472	13.095	8.802	1.882	0.15
1964	-1.987	-2.807	-1.799	1.648	4.851	9.127	15.217	14.757	9.871	9.741	-0.475	-0.15
1965	-2.136	-1.22	-0.21	2.741	5.08	9.465	13.835	13.283	8.207	8.27	2.584	-2.659
1966	-2.777	-3.602	0.969	4.37	9.331	10.646	14.085	16.256	11.83	6.918	3.193	-0.931
1967	-1.184	-0.705	-0.527	-3.126	5.431	9.126	16.117	16.92	12.855	7.171	3.847	-4.104
1968	-2.465	0.896	0.719	2.48	6.35	12.027	16.392	11.952	10.827	6.411	1.931	-2.604

Sheet1

1969	-0.763	-4.465	-1.838	2.114	8.31	10.408	15.501	15.705	13.364	4.072	1.898	0.482
1970	-0.172	0.636	0.241	-0.123	7.199	10.813	16.276	16.305	9.626	5.062	3.139	-3.356
1971	-1.833	-1.474	-0.759	1.419	4.624	9.607	15.85	16.593	9.942	3.887	1.333	-3.73
1972	-4.146	-0.224	3.418	2.154	7.652	12.198	16.241	15.191	9.685	5.333	0.252	-4.159
1973	-3.823	-1.519	-1.67	2.471	8.759	11.98	15.093	14.127	10.266	5.783	1.285	-0.554
1974	-2.248	-2.276	0.785	1.09	7.102	12.862	14.655	14.005	12.607	6.738	1.825	-1.894
1975	-1.722	-2.776	-1.323	-2.006	5.612	10.304	15.181	12.632	13.345	5.14	0.885	0.179
1976	-1.138	-1.922	-1.28	1.429	8.042	9.734	14.652	10.173	11.182	6.467	3.583	-1.425
1977	-2.802	-0.023	-2.981	4.707	2.588	13.652	14.651	15.492	11.065	7.901	3.512	1.543
1978	-0.223	-0.65	3.081	1.91	5.623	10.088	14.926	14.464	9.472	9.186	-0.398	-4.49
1979	-4.344	-2.382	0.464	2.051	7.177	10.654	13.892	13.396	12.866	7.693	0.526	0.217
1980	-0.514	0.589	-1.65	3.314	5.219	8.535	14.801	13.84	11.39	7.107	3.499	0.626
1981	0.576	-0.427	0.35	4.501	6.877	13.376	14.995	16.35	13.602	4.176	2.678	1.942
1982	-4.37	-0.69	-1.185	0.352	6.156	9.204	13.967	14.985	9.673	4.999	0.294	-1.749
1983	-0.871	-0.57	-0.25	-0.489	5.466	10.154	11.963	13.868	11.833	7.64	1.113	0.661
1984	-0.575	-1.367	2.126	1.484	8.028	9.498	16.497	15.225	12.562	3.464	0.696	-2.992
1985	-2.203	-1.842	-1.416	4.864	6.554	13.385	16.042	13.982	8.365	5.781	-0.87	-2.115
1986	2.073	0.785	3.057	3.326	7.134	12.864	13.898	16.711	7.243	6.143	3.628	-0.115
1987	-2.852	-1.433	0.654	6.382	8.163	12.531	13.003	15.902	12.899	9.566	2.541	-2.546
1988	-2.342	0.422	1.551	4.49	6.666	11.916	17.174	16.86	12.651	10.7	1.853	-2.876
1989	-4.002	-3.854	1.538	5.473	6.669	11.907	15.361	13.219	11.014	5.656	2.225	-0.084
1990	-1.094	-4.045	1.614	5.633	5.579	10.527	16.102	14.89	12.841	8.444	1.946	-4.8
1991	-1.327	2.645	-1.517	1.943	4.34	9.995	16.304	15.539	13.482	9.162	2.796	-1.387
1992	-1.364	0.697	2.538	6.477	10.705	11.984	14.382	16.496	12.978	9.131	1.705	-3.519
1993	-5.698	-3.364	2.956	3.129	7.996	9.372	13.208	13.903	12.096	7.361	1.307	-1.332
1994	-0.441	-2.352	2.667	4.074	7.804	11.915	16.846	15.965	11.994	5.921	-2.596	-1.511
1995	-1.082	1.764	-0.206	1.246	4.903	8.987	13.904	14.662	12.992	8.353	5.999	0.609
1996	0.329	0.321	0.749	3.317	6.486	11.653	17.104	15.782	11.178	6.066	2.706	0.356
1997	-0.855	-0.686	3.133	2.743	9.309	10.278	14.241	15.126	12.121	5.889	3.141	-2.605
1998	-0.215	-2.55	0.432	1.18	2.801	9.133	15.807	16.541	12.171	5.04	1.842	-2.599
1999	-0.337	-1.818	0.01	0.593	6.359	10.432	14.952	13.427	12.123	8.521	4.306	-1.161
2000	-0.131	-0.037	1.079	4.43	7.565	13.189	14.109	15.489	11.226	6.126	-0.311	0.22
2001	-2.153	-2.729	2.916	1.418	10.564	13.014	15.135	16.91	13.563	9.875	3.269	-1.184
2002	-2.72	-0.354	-0.842	3.995	6.4	12.836	17.377	14.899	12.675	6.548	2.818	-0.784
2003	2.253	-1.23	2.102	0.447	7.1	12.929	17.578	15.767	13.53	10.609	0.221	-0.36

Sheet1

2004	-1.749	-1.715	4.468	4.837	7.77	12.684	16.78	15.726	12.169	5.793	0.809	-0.927
2005	-3.058	-0.802	1.521	2.209	6.959	9.383	17.76	16.402	10.111	7.359	3.529	0.684
2006	-0.691	-1.096	-2.314	2.669	8.391	13.562	17.72	14.836	12.053	6.201	3.081	-1.34
2007	-3.403	-0.019	2.387	4.094	8.127	12.395	17.235	16.825	11.205	5.915	3.399	-2.266
2008	-3.204	-2.217	0.788	2.59	6.794	12.002	16.206	17.293	12.867	7.237	3.8	-2.107
2009	-1.001	-1.433	-0.592	2.942	9.405	10.598	16.67	15.428	14.857	5.671	2.778	-3.914
2010	-0.628	-0.056	0.256	0.703	3.466	10.879	16.414	14.558	12.752	8.231	0.724	-0.189
2011	-0.65	-3.264	-1.238	1.384	3.661	9.464	14.899	15.048	14.512	7.805	1.413	-1.782
2012	0.121	-1.114	0.252	4.027	7.723	11.92	16.27	17.573	14.739	8.998	3.546	-1.447
2013	-4.095	-1.637	2.867	4.845	7.43	13.416	18.201	15.283	13.094	5.268	3.095	-3.511
2014	0.739	1.321	2.884	4.51	8.015	12.846	18.654	15.668	14.304	9.681	4.079	1.055
2015	1.303	3.256	4.355	3.662	7.299	14.904	15.59	16.553	14.405	10.477	-0.11	-1.674
2016	-1.002	0.825	2.521	5.433	7.313	14.177	16.03	16.57	12.555	7.486	3.601	-1.037
2017	-2.88	-0.823	1.674	2.497	7.876	13.125	17.5	17.651	11.98	6.584	4.845	0.096
2018	1.555	-1.883	-0.901	4.326	8.269	13.231	18.487	17.037	12.905	7.181	2.871	-0.317
2019	-0.192	-4.818	-0.788	5.264	5.933	12.554	15.674	17.276	12.161	4.653	3.39	-0.57
2020	0.351	0.734	-0.609	4.765	7.828	11.721	16.735	17.842	14.292	9.952	1.794	-0.401
2021	-0.565	-0.547	0.199	4.697	7.882	16.324	19.929	17.091	14.563	6.38	5.552	-0.27

Figure S1. Time series plots and scatterplots summarizing strength of regression models for runoff, seasonal-total precipitation (P), and seasonal-average temperature (T) at point 7 from tree rings. A) Runoff. B) Cool-season P , C) Warm-season P , C) Cool-season T , and D) Warm-season T .

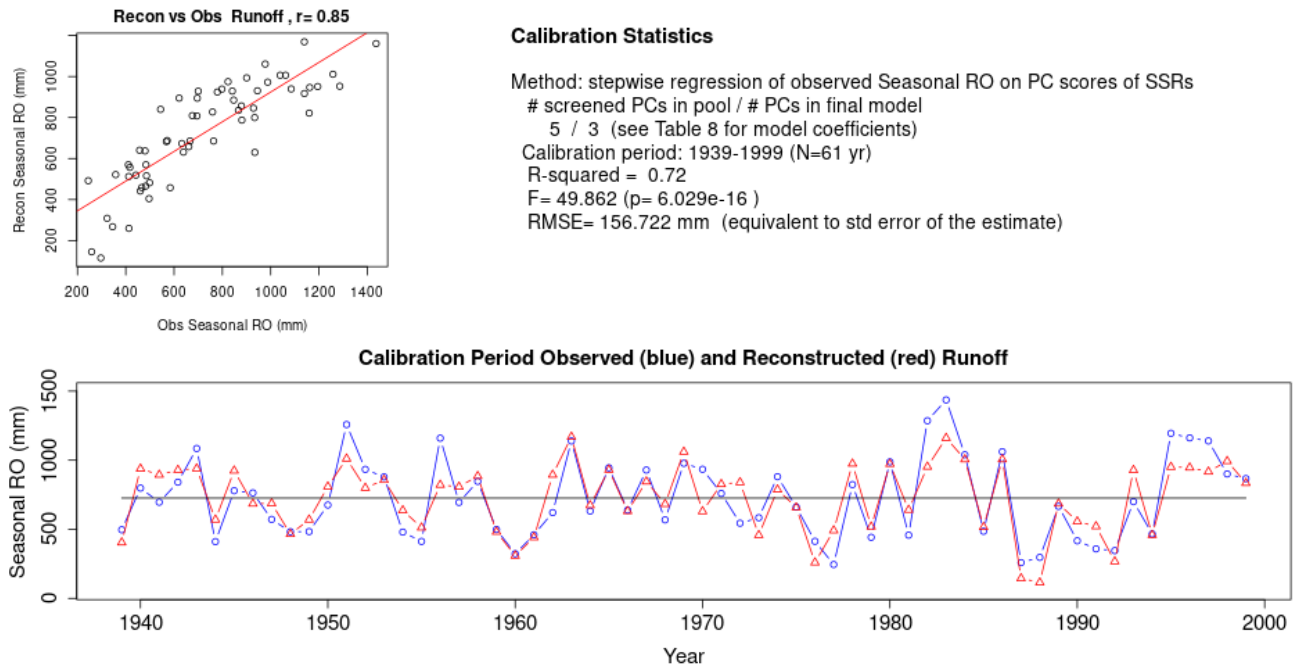


Fig. S1A. Calibration results for point-7 runoff (RO). At upper left is scatterplot of reconstruction on the observed, with annotated correlation coefficient. At bottom are corresponding time series plots. At upper right are statistics, meanings self-evident in context of main paper. This figure is one of 16 figures and 8 tables produced by the R script ReconAnalog.R Supplemental Material file ReconAnalogTCRB.zip contains all necessary functions and input data to reproduce those figures and tables.

FigureS1.pdf

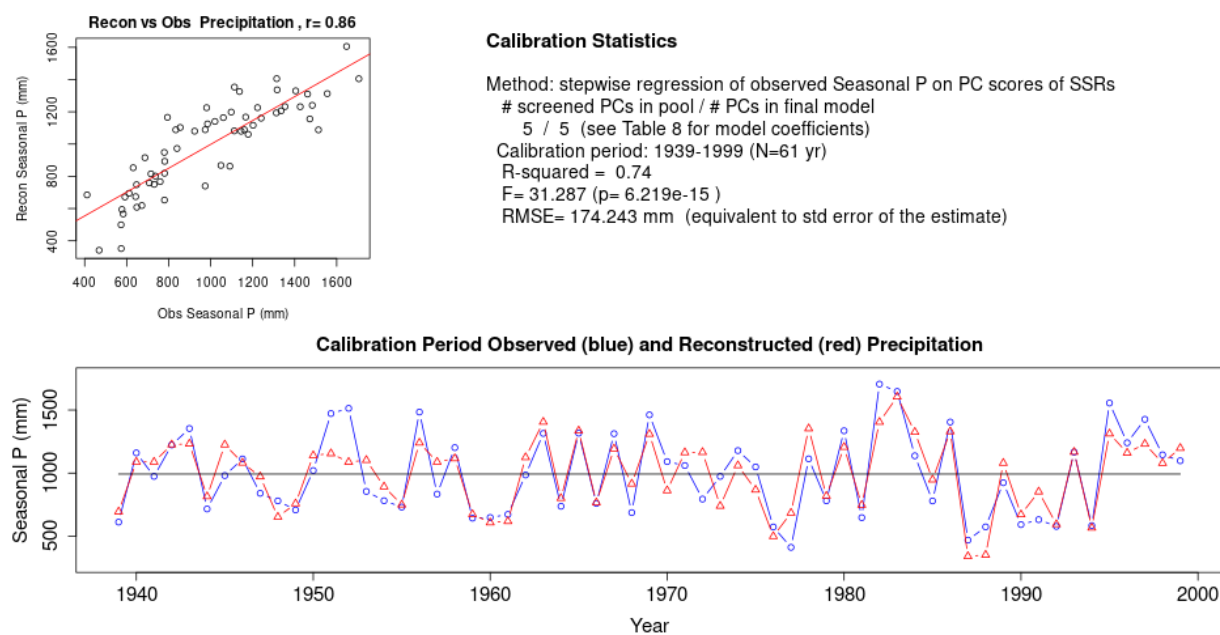


Fig. S1B. Calibration results for point-7 cool-season *P*. Remainder of caption as in Fig S1A.

FigureS1.pdf

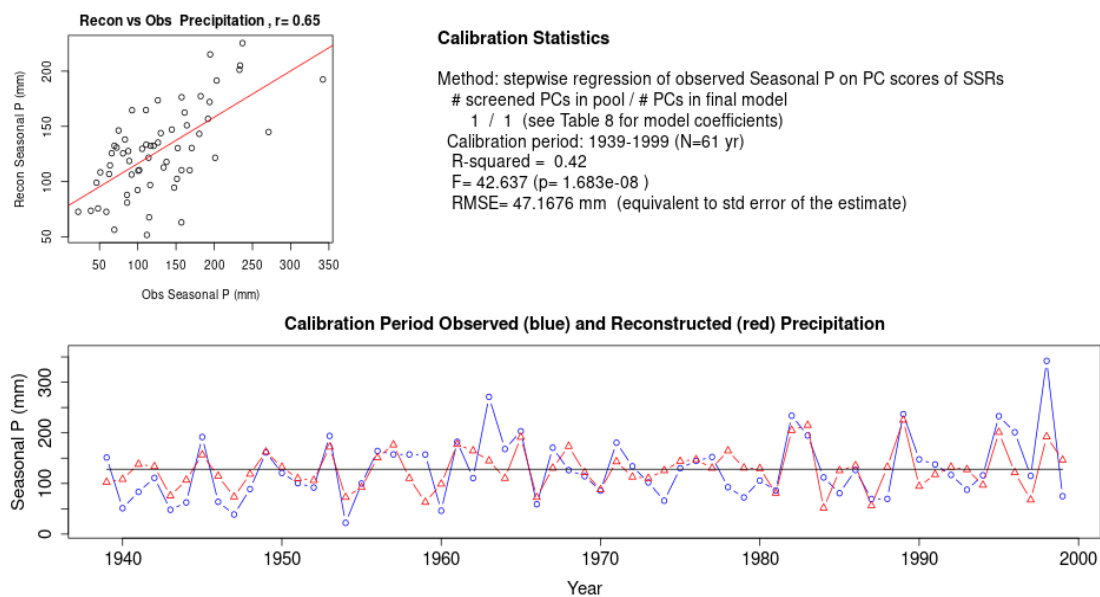


Fig. S1C. Calibration results for point-7 warm-season P . Remainder of caption as in Fig S1A.

FigureS1.pdf

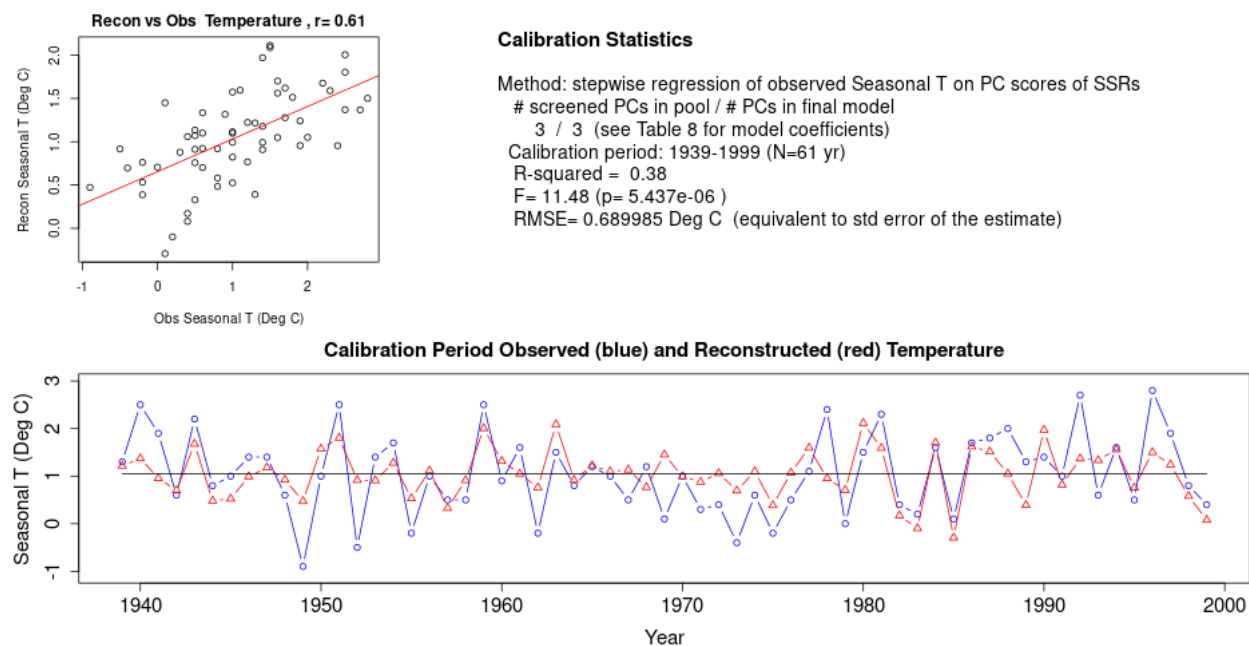


Fig. S1D. Calibration results for point-7 cool-season T . Remainder of caption as in Fig S1A.

FigureS1.pdf

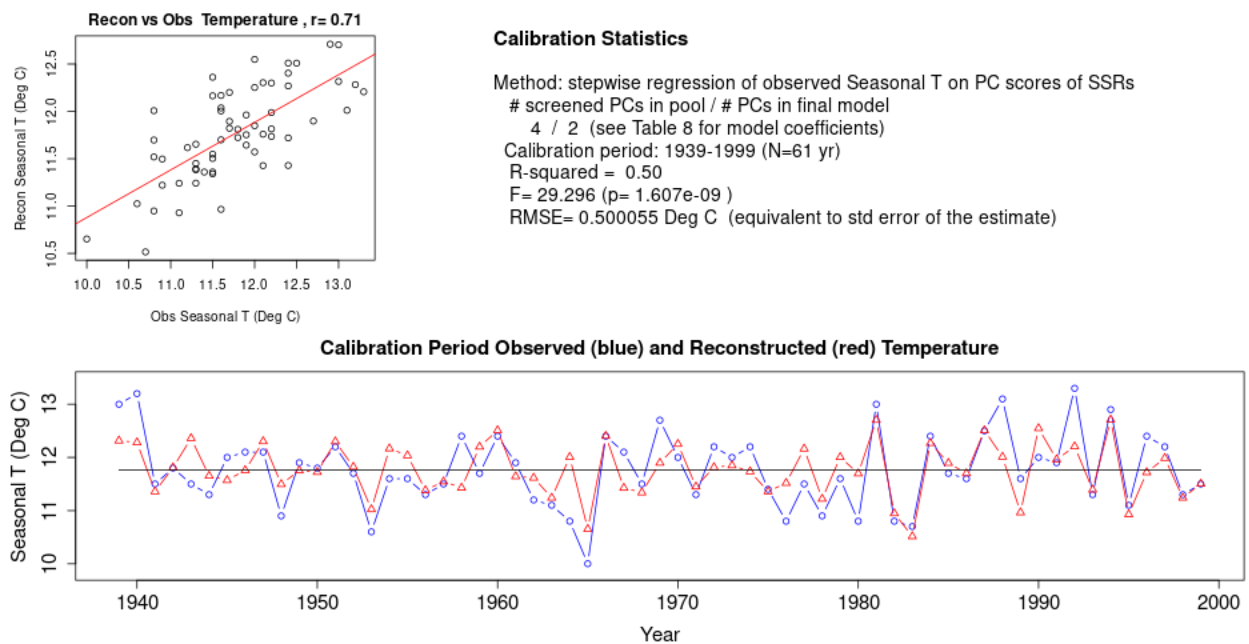


Fig. S1E. Calibration results for point-7 warm-season T . Remainder of caption as in Fig S1A.

Figure S2. Maps showing chronologies whose single-site reconstructions (SSRs) pass screening for reconstruction of five variables at point 7. Symbols sized proportional to the adjusted R^2 of the SSR model and color-coded for the sign of the first predictor to enter the stepwise regression model. (A) Runoff (RO). (B) Cool-season precipitation (P). (C) Warm-season P . (D) Cool-season temperature (T). (E) Warm-season T . These five maps are analogous to Fig. 6 in the main paper. Figure 6 in the main paper is the same as Fig. S2E below. Statistics for the SSR models passing screening for the five predictands are list in Table S5.

Figure S2A. Map showing chronologies whose single-site reconstructions (SSRs) pass screening for reconstruction of RO at point 7. See “Figure S2” above for remainder of caption.

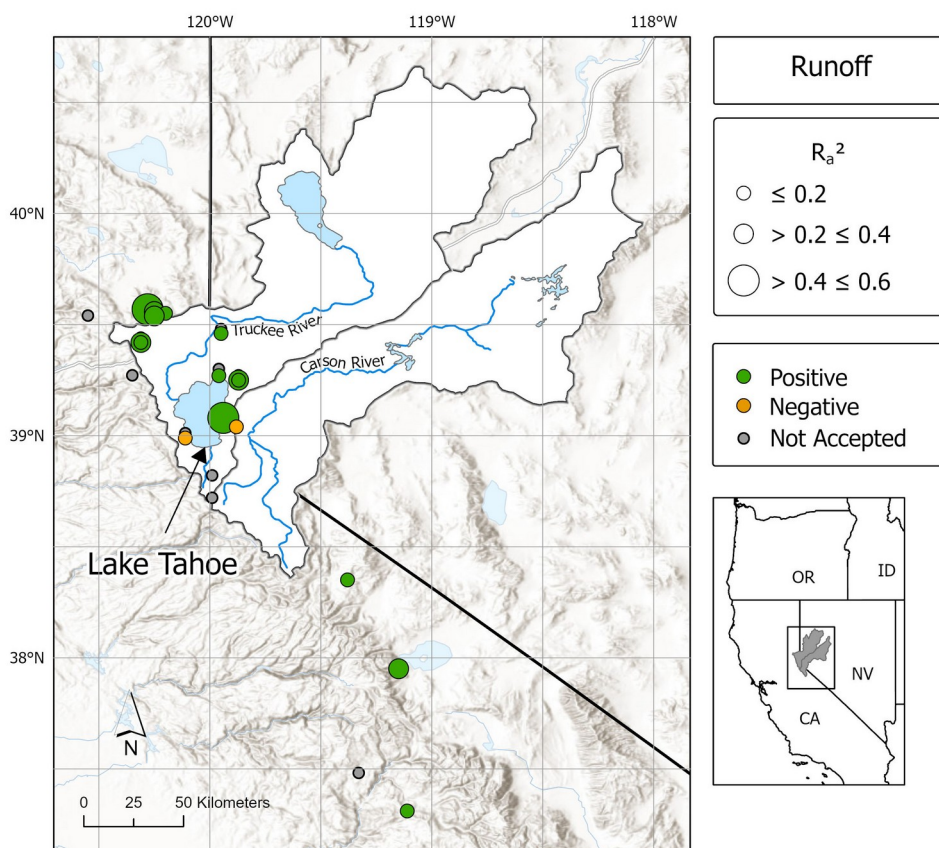


Figure S2B. Map showing chronologies whose single-site reconstructions (SSRs) pass screening for cool-season P at point 7. See “Figure S2” above for remainder of caption.

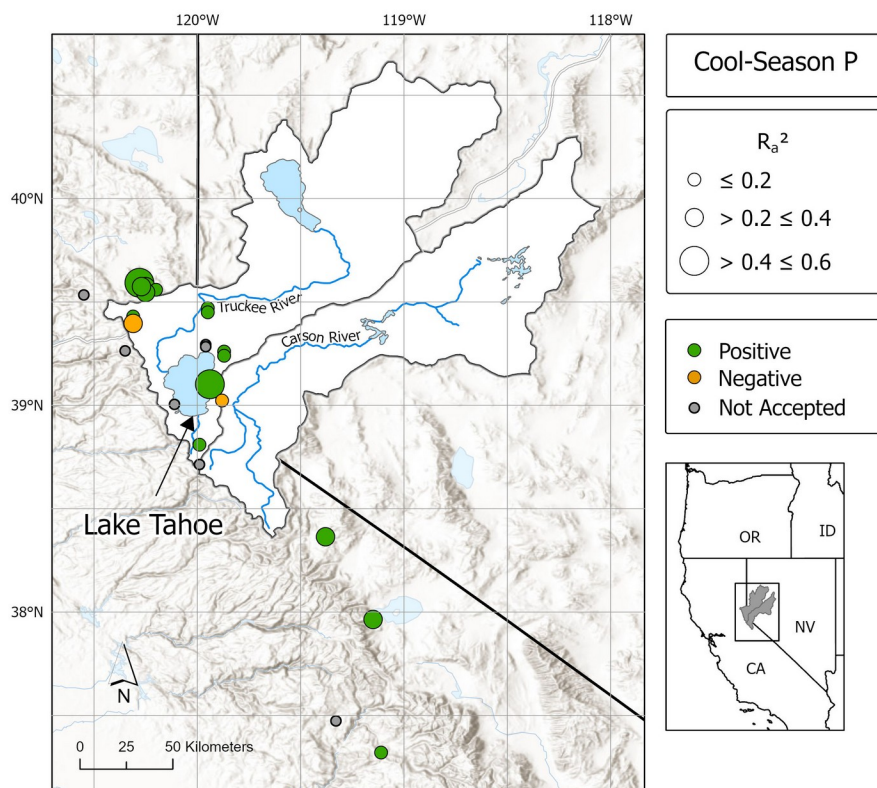


Figure S2C. Map showing chronologies whose single-site reconstructions (SSRs) pass screening for warm-season P at point 7. See “Figure S2” above for remainder of caption.

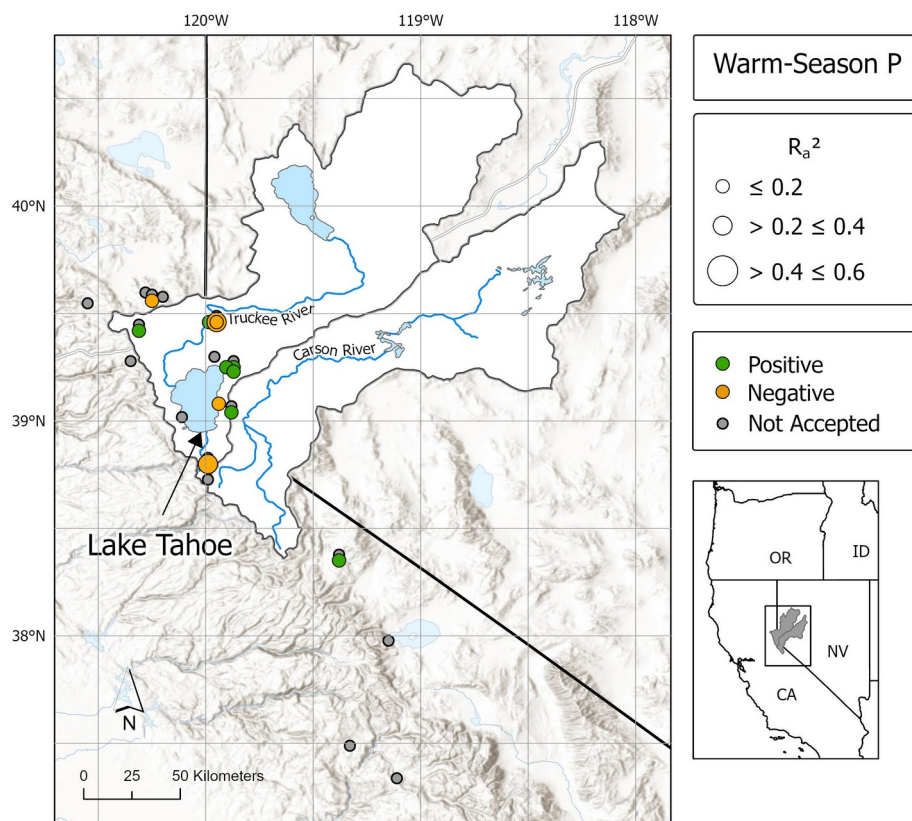


Figure S2D. Map showing chronologies whose single-site reconstructions (SSRs) pass screening for cool-season T at point 7. See “Figure S2” above for remainder of caption.

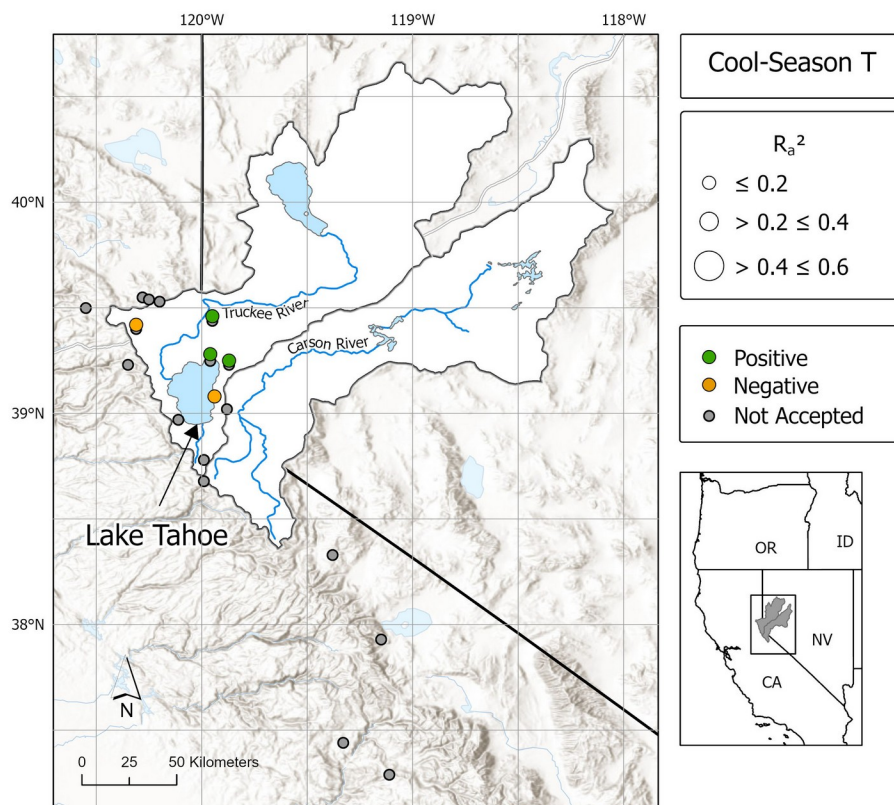


Figure S2E. Map showing chronologies whose single-site reconstructions (SSRs) pass screening for warm-season T at point 7. This figure is identical to main paper Fig. 6. See “Figure S2” for remainder of caption.

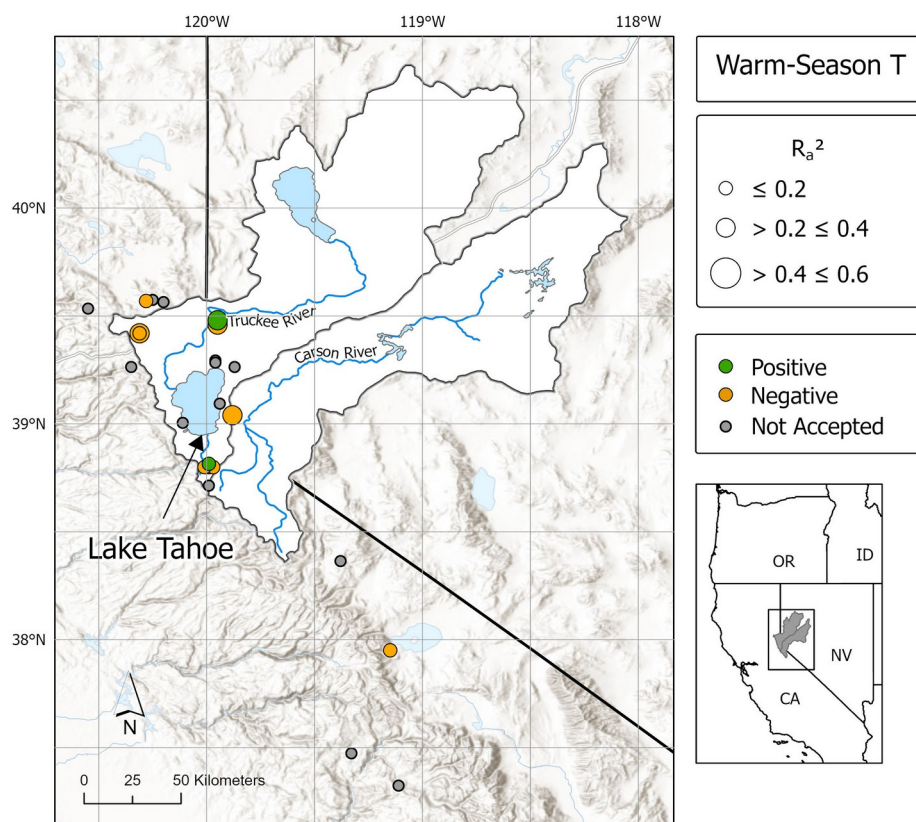


Figure S3. Time series plots, 1688-1999, showing agreement of direct and indirect reconstructions of point-7 runoff and consistency with other published reconstructions. (A) Indirect and direct reconstructions of Point-7 runoff. (B) Z-scores of water-year natural-flow reconstruction of Carson River (Harris and Csank 2023) and Truckee River (Biondi and Meko 2019). Common period for the four time series is $N=312$ years. Correlation between annual series in (A) is $r = 0.89$. Correlation of indirect reconstruction with the Truckee and Carson reconstructions for the 312 years plotted in (B) is $r=0.70$ and $r=0.61$, respectively. Correlation of direct reconstruction with the Truckee and Carson reconstructions plotted in (B) is $r=0.71$ and $r=0.62$, respectively. Lag-1 autocorrelation of the indirect and direct reconstructions over 1688-1999 is 0.04 and 0.03, respectively (not significant at $p>0.05$). Lag-1 autocorrelation of the Truckee and Carson reconstructions in (B) is 0.32 and 0.31, respectively (positive autocorrelation; significant at $p<0.05$).

Note that the 1688 start year of the common period of the direct and indirect reconstructions is one year later than the 1687 start year for the direct reconstruction because the water balance model is run on calendar-year (Jan-Dec) monthly inputs of precipitation and temperature. The 1687-1999 tree-ring reconstructions of seasonal P and T, when disaggregated to monthly data, cover *water years* 1687-1999, or October, 1686, through September, 1999. The first *full* calendar year of disaggregated monthly P and T input and water-balance model output is therefore 1687, which provides a first year of water-year reconstructed runoff of 1688

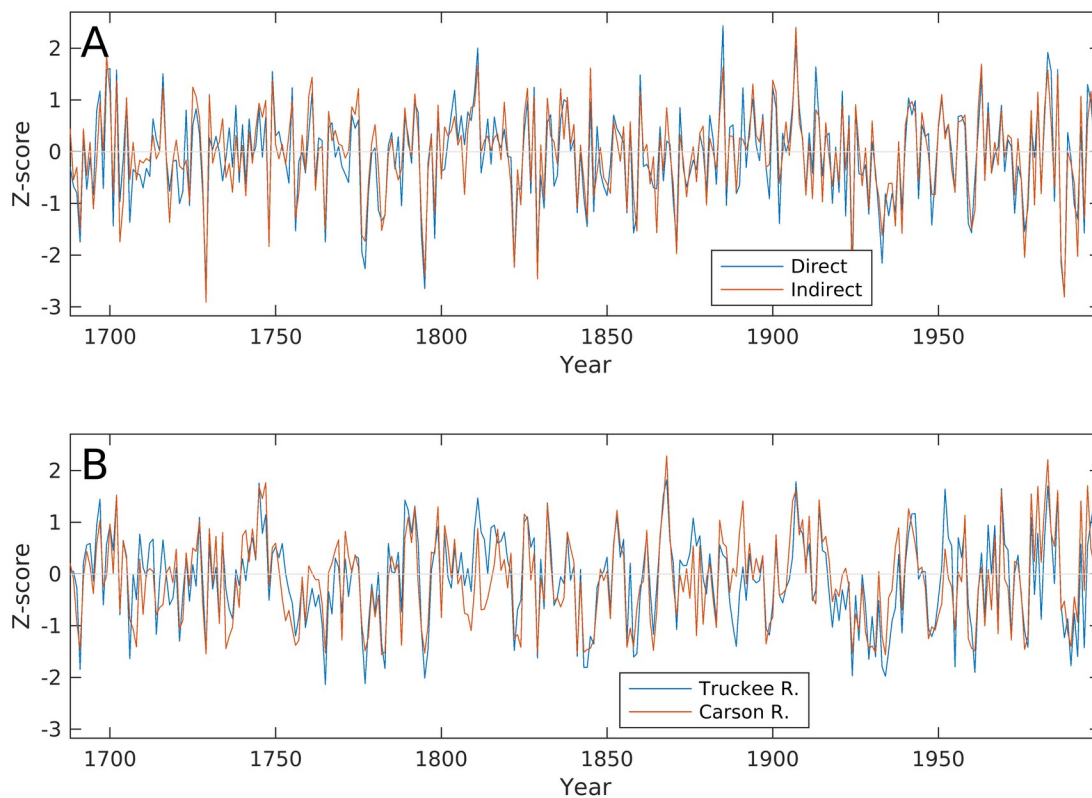


Figure S4. Monthly point-7 water balance (WB) model input precipitation (P) and (T) for reconstruction water year 1779. The WB output monthly runoff, snowmelt, soil moisture and actual evapotranspiration are plotted in Figure 11 of the main paper to illustrate how a warming of 3 C leads to an increase in annual runoff in some years.

The blue bars below are the model 1779 inputs, computed by temporally disaggregating seasonal (cool season and warm season) tree-ring reconstructions of P and T by the analog-year method described in an Appendix C of the paper. The red bars are "average" conditions, computed as the long-term monthly median of reconstructed monthly P and T for the 312 years 1688-1999.

The totals and averages listed in the legends of the bar charts below are the sum (P) and mean (T) of the plotted monthly long-term medians. The data indicate that 1779, although imbedded in the severe 10-year drought of 1776-1785, was a wetter-than-normal reconstructed year. As described in Appendix C, the reconstructed seasonal P or T in any reconstruction year is distributed over months (disaggregated) in the same proportion as the observed point-7 monthly precipitation in the analog year selected from the observed climate data for water years 1901-1999. The analog year for any reconstruction year k is defined as the year in 1901-1999 whose reconstructed season P or T is closest to the reconstructed value in year k . The analog years for 1779 are as follows:

cool-season (Oct-Apr) P	1938
warm-season (May-Sep) P	1968
cool-season (Oct-Apr) T	1975
warm-season (May-Sep) T	1911

