Supplementary material

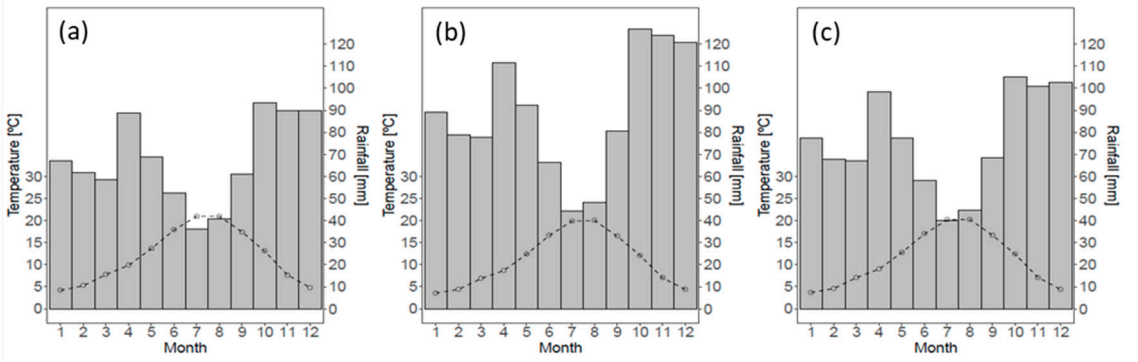

Figure S1. Ombrothermic diagrams showing the mean monthly distribution of temperature (dashed line) and precipitation (grey bars) at Urriés (**a**), Los Pintanos (**b**) and Monte Alto (**c**) study sites.

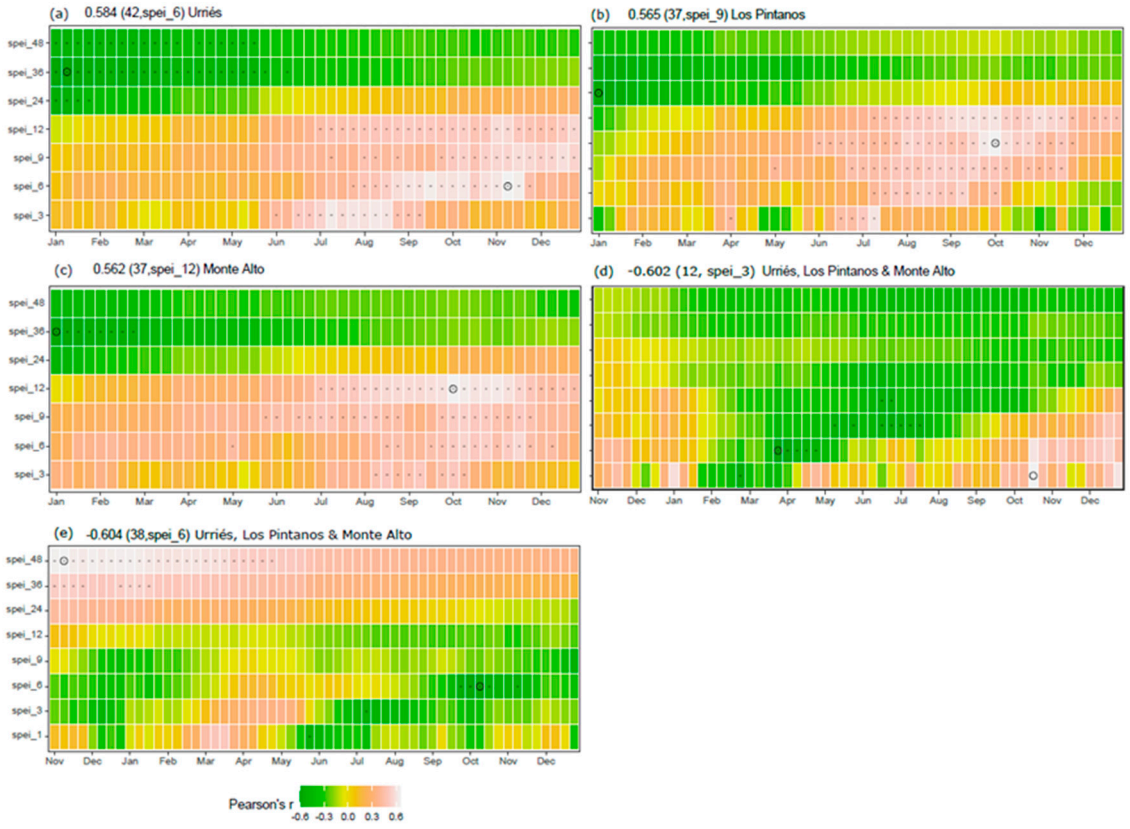

Figure S2. Correlations between BAI, $\delta^{18}O$ and WUEi time series and SPEI time series at various time scales (y axis) and weeks of the year (x axis). Significant correlations are indicated with a dot, and the maximum significant correlation for each case is indicated with a circle. Correlation between BAI and SPEI in Urriés (significant at week 42, 6-month SPEI) (**a**), BAI and SPEI in Los Pintanos (significant at week 37, 9-month) (**b**), BAI and SPEI in Monte Alto (significant at week 37, 12-month SPEI) (**c**), $\delta^{18}O$ and SPEI in Urriés, Los Pintanos and Monte Alto (significant at week 12, 3-month SPEI) (**d**), WUEi and SPEI in Urriés, Los Pintanos and Monte Alto (significant at week 38, 6-month SPEI) (**e**).

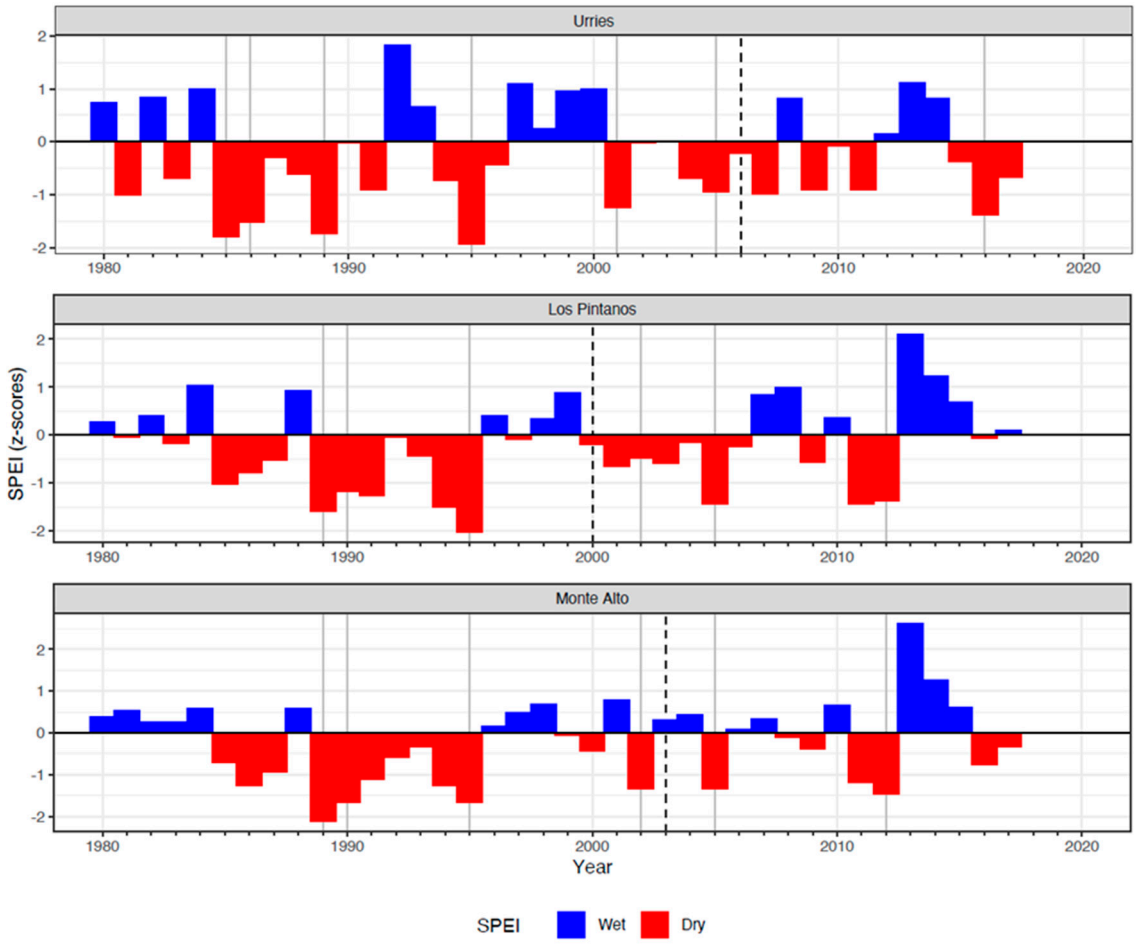

Figure S3. SPEI time series at 6-month and 42-week time scale for Urriés, 9-months time scale week 37 in Los Pintanos and 12- months 37 week in Monte

Alto study sites. Solid vertical lines indicate the year of thinning at each site. Red and blue bars indicate dry and wet conditions, respectively.

Table S1. Tree-ring width statistics.

Site	Treatment	No. trees / No. cores	Time span	Mean tree-ring width ± SD (mm)	First-order autocorrelation	Mean correlation with site mean series
Urriés	Control	10 / 20	1972–2017	1.54 ± 1.13	0.77	0.64
	Thinned	10 / 20	1973–2017	2.11 ± 0.87	0.53	0.62
Los Pintanos	Control	10 / 20	1973–2017	1.54 ± 1.12	0.75	0.76
	Thinned	10 / 20	1967–2017	1.94 ± 1.17	0.71	0.70
Monte Alto	Control	10 / 20	1967–2017	1.63 ± 0.75	0.75	0.65
	Thinned	10 / 20	1969–2017	2.11 ± 1.30	0.71	0.79

Table S2. Summary of the linear models of the effect of thinning on growth (BAI) on Urriés, Los Pintanos and Monte Alto study sites. The periods correspond to the pre- (*preT*) and post-thinning (*postT*) periods. Significance levels: $^{**}p < 0.01$; $^{***}p < 0.001$.

Site	Period	Treatment	Coefficient	Estimate	Std. Error	t value	Pr(>|z|)
Urriés	*preT*	control	Intercept	0.750	0.080	9.373	< 2e-16***
Urriés	*preT*	thinned	Intercept	1.024	0.092	11.152	< 2e-16***
Urriés	*postT*	control	Intercept	0.594	0.100	5.954	2.61e-09***
Urriés	*postT*	thinned	Intercept	1.646	0.131	12.536	< 2e-16***
Urriés	*preT*	control	BAI_prev	0.569	0.033	17.439	< 2e-16***
Urriés	*preT*	thinned	BAI_prev	0.460	0.039	11.786	< 2e-16***
Urriés	*postT*	control	BAI_prev	0.579	0.060	9.662	< 2e-16***
Urriés	*postT*	thinned	BAI_prev	0.318	0.051	6.208	5.36e-10***
Urriés	*preT*	control	SPEI	0.094	0.019	5.063	4.13e-07***

Urriés	*preT*	thinned	SPEI	0.105	0.018	5.868	4.41e-09***
Urriés	*postT*	control	SPEI	0.189	0.033	5.651	1.59e-08***
Urriés	*postT*	thinned	SPEI	0.097	0.034	2.89	0.00385**
Los Pintanos	*preT*	control	Intercept	0.6393	0.0659	9.705	< 2e-16***
Los Pintanos	*preT*	thinned	Intercept	0.7256	0.0782	9.278	< 2e-16***
Los Pintanos	*postT*	control	Intercept	0.2817	0.0683	4.127	3.67e-05***
Los Pintanos	*postT*	thinned	Intercept	0.9185	0.0952	9.653	< 2e-16***
Los Pintanos	*preT*	control	BAI_prev	0.6560	0.0255	25.718	< 2e-16***
Los Pintanos	*preT*	thinned	BAI_prev	0.6262	0.0349	17.942	< 2e-16***
Los Pintanos	*postT*	control	BAI_prev	0.7278	0.0378	19.239	< 2e-16***
Los Pintanos	*postT*	thinned	BAI_prev	0.5270	0.0431	12.238	< 2e-16***
Los Pintanos	*preT*	control	SPEI	0.1264	0.0236	5.352	8.70e-08***
Los Pintanos	*preT*	thinned	SPEI	0.1275	0.0225	5.666	1.46e-08***
Los Pintanos	*postT*	control	SPEI	0.1938	0.0223	8.708	< 2e-16***
Los Pintanos	*postT*	thinned	SPEI	0.1639	0.0212	7.723	1.14e-14***
Monte Alto	*preT*	control	Intercept	0.4561	0.0470	9.70	< 2e-16***
Monte Alto	*preT*	thinned	Intercept	0.4584	0.0358	12.79	< 2e-16***
Monte Alto	*postT*	control	Intercept	0.1105	0.0497	2.22	0.0263*
Monte Alto	*postT*	thinned	Intercept	0.7319	0.1304	5.61	2.00e-08***
Monte Alto	*preT*	control	BAI_prev	0.7278	0.0319	22.80	< 2e-16***
Monte Alto	*preT*	thinned	BAI_prev	0.7756	0.0211	36.76	< 2e-16***
Monte Alto	*postT*	control	BAI_prev	0.8606	0.0430	20.00	< 2e-16***
Monte Alto	*postT*	thinned	BAI_prev	0.6665	0.0612	10.89	< 2e-16***
Monte Alto	*preT*	control	SPEI	0.1109	0.0219	5.06	4.12e-07***
Monte Alto	*preT*	thinned	SPEI	0.1135	0.0213	5.34	9.38e-08***
Monte Alto	*postT*	control	SPEI	0.1788	0.0220	8.13	4.29e-16***
Monte Alto	*postT*	thinned	SPEI	0.1757	0.0216	8.14	4.09e-16***

Table S3. Summary of the linear models of the effect of thinning on WUEi values on Urriés, Los Pintanos and Monte Alto study sites. The periods correspond to the pre- (*preT*) and post-thinning (*postT*) periods. Significance levels: **0.01 < p < 0.05; ** p < 0.01; *** p < 0.001.

Site	Period	Treatment	Coefficient	Estimate	Std. Error	t value	Pr(>|z|)
Urriés	*preT*	control	Intercept	92.553	1.3520	68.455	9.86e-49***
Urriés	*preT*	thinned	Intercept	96.784	1.3520	71.585	1.23e-49***
Urriés	*postT*	control	Intercept	99.610	1.7902	55.642	1.49e-44***
Urriés	*postT*	thinned	Intercept	108.101	1.7587	61.465	1.47e-46***
Urriés	*preT*	control	SPEI	-4.276	1.3683	-3.125	3.03e-03**
Urriés	*preT*	thinned	SPEI	-2.088	1.3683	-1.526	1.33e-01
Urriés	*postT*	control	SPEI	-4.808	1.9395	-2.479	1.68e-02*
Urriés	*postT*	thinned	SPEI	-3.432	1.7873	-1.920	6.09e-02*
Los Pintanos	*preT*	control	Intercept	92.126	1.1305	81.489	4.00e-53***
Los Pintanos	*preT*	thinned	Intercept	101.312	1.1305	89.614	4.30e-55***
Los Pintanos	*postT*	control	Intercept	102.306	1.3108	78.047	3.13e-52***
Los Pintanos	*postT*	thinned	Intercept	108.183	1.3108	82.530	2.18e-53***
Los Pintanos	*preT*	control	SPEI	-3.264	1.1157	-2.925	5.23e-03**
Los Pintanos	*preT*	thinned	SPEI	-1.852	1.1157	-1.660	1.033e-01
Los Pintanos	*postT*	control	SPEI	-3.780	1.3730	-2.753	8.30e-03**
Los Pintanos	*postT*	thinned	SPEI	-4.4280	1.3730	-3.225	2.26e-03**
Monte Alto	*preT*	control	Intercept	95.870	1.4145	67.774	2.57e-49***
Monte Alto	*preT*	thinned	Intercept	92.139	1.4145	65.136	1.69e-48***
Monte Alto	*postT*	control	Intercept	103.157	1.8401	56.061	2.08e-45***
Monte Alto	*postT*	thinned	Intercept	101.051	1.8401	54.917	5.51e-45***
Monte Alto	*preT*	control	SPEI	-2.0839	1.4315	-1.455	1.52e-01
Monte Alto	*preT*	thinned	SPEI	-2.452	1.4315	-1.713	9.31e-02*
Monte Alto	*postT*	control	SPEI	-0.8912	1.8700	-0.476	6.35e-01
Monte Alto	*postT*	thinned	SPEI	-1.2128	1.8700	-0.648	5.19e-01

Table S4. Summary of the linear models of the effect of thinning on $\delta^{18}O$ values on Urriés, Los Pintanos and Monte Alto study sites. The periods correspond to the pre- (*preT*) and post-thinning (*postT*) periods. Significance levels: **0.01 < p < 0.05; ** p < 0.01; *** p < 0.001.

Site	Period	Treatment	Coefficient	Estimate	Std. Error	t value	Pr(>|z|)

Urriés	*preT*	control	Intercept	26.32812	0.15364	171.36293	2.23e-67***
Urriés	*preT*	thinned	Intercept	26.26209	0.15364	170.93316	2.51e-67***
Urriés	*postT*	control	Intercept	25.49958	0.18932	134.68989	1.79e-62***
Urriés	*postT*	thinned	Intercept	26.27172	0.18814	139.64121	3.30e-63***
Urriés	*preT*	control	SPEI	-0.14586	0.13874	-1.05133	2.98e-01
Urriés	*preT*	thinned	SPEI	-0.22248	0.13874	-1.60358	1.16e-01
Urriés	*postT*	control	SPEI	-0.14614	0.16356	-0.89350	3.76e-01
Urriés	*postT*	thinned	SPEI	-0.33976	0.15878	-2.13980	3.76e-02*
Los Pintanos	*preT*	control	Intercept	26.68796	0.22772	117.19440	1.16e-60***
Los Pintanos	*preT*	thinned	Intercept	27.10257	0.22772	119.01504	5.56e-61***
Los Pintanos	*postT*	control	Intercept	26.56691	0.21805	121.83773	1.81e-61***
Los Pintanos	*postT*	thinned	Intercept	26.54633	0.21805	121.74334	1.88e-61***
Los Pintanos	*preT*	control	SPEI	0.15272	0.19871	0.76855	4.46e-01
Los Pintanos	*preT*	thinned	SPEI	0.08494	0.19871	0.42747	6.71e-01
Los Pintanos	*postT*	control	SPEI	-0.25558	0.19301	-1.32416	1.92e-01
Los Pintanos	*postT*	thinned	SPEI	-0.31484	0.19301	-1.63118	1.09e-01
Monte Alto	*preT*	control	Intercept	26.80094	0.18596	144.12444	5.83e-65***
Monte Alto	*preT*	thinned	Intercept	27.01239	0.18596	145.26154	4.00e-65***
Monte Alto	*postT*	control	Intercept	25.82794	0.22771	113.42414	5.56e-60***
Monte Alto	*postT*	thinned	Intercept	26.66034	0.22771	117.07961	1.22e-60***
Monte Alto	*preT*	control	SPEI	0.13079	0.16792	0.77891	4.40e-01
Monte Alto	*preT*	thinned	SPEI	0.23802	0.16792	1.41742	1.63e-01
Monte Alto	*postT*	control	SPEI	-0.18732	0.19218	-0.97473	3.35e-01
Monte Alto	*postT*	thinned	SPEI	-0.23935	0.19218	-1.24543	2.19e-01