

## Supplementary material

**Table S1.** Statistics of fitted linear mixed effects models and periods with significant ( $p < 0.05$ ) differences in basal area increment data between living (ND) and dead trees according to Student's *t* tests.

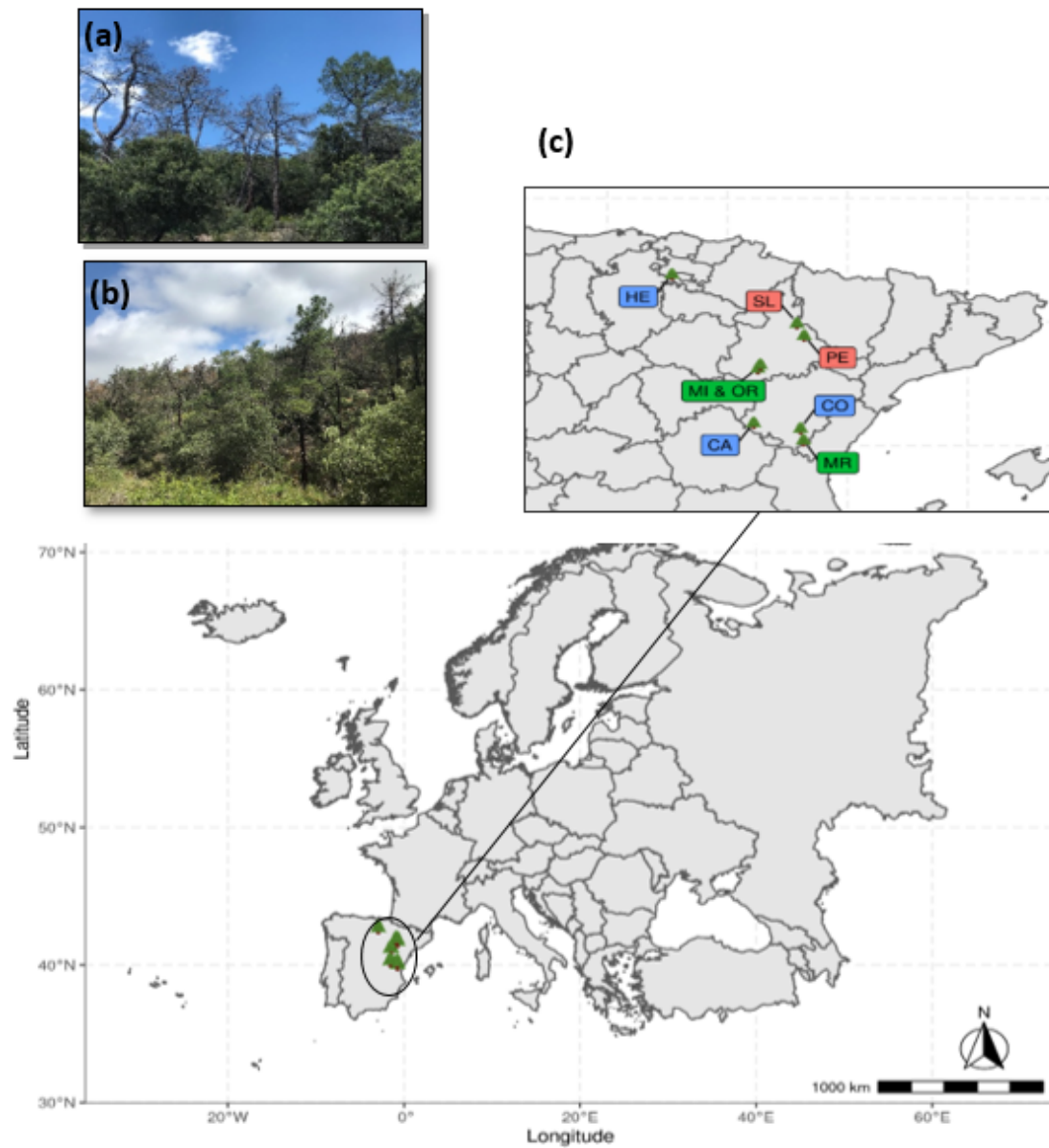
Site	Period	Variable	Estimate	SE	<i>z</i> value	<i>p</i>	Years or periods with significant differences in growth between living and dead trees
CA	1950–2019	Intercept	0.460	0.086	0.002	1.0 e-07	1950–1954, 1961–1965, 1980–1999, 2002–2006, 2012–2015
		ND	-0.002	0.106	-0.018	0.254	
		year	0.007	0.002	2.864	0.004	
CO	1950–2012	Intercept	1.521	0.158	9.627	2.0 e-16	1967–1969, 1973–2012
		ND	-0.703	0.179	-4.001	6.3 e-05	
		year	-0.006	0.002	-4.283	1.8 e-05	
OR	1950–2016	Intercept	-0.777	0.045	-17.329	1.0 e-16	1967–2007, 2011–2015
		ND	0.010	0.062	0.160	0.872	
		year	0.004	0.002	2.472	0.013	
MI	1950–2019	Intercept	0.828	0.048	-9.950	1.7 e-12	1972–1976, 1980–1985, 1990–1994, 1999–2000, 2005–2006, 2017–2018
		ND	0.006	0.068	0.116	0.907	
		year	-0.009	0.002	-3.637	6.7 e-08	
PE	1980–2010	Intercept	-0.159	0.069	-2.897	0.022	1984–1986, 2002, 2006–2010
		ND	0.046	0.100	0.484	0.629	
		year	-0.002	0.009	-1.435	0.810	
SL	1980–2010	Intercept	-0.011	0.082	-0.240	0.887	1988–1997, 1999–2010
		ND	-0.063	0.106	-0.596	0.551	
		year	-0.026	0.009	-2.956	0.030	

**Table S2.** Statistics of models of basal area increment fitted to each site. The two last columns show the increment in the corrected Akaike information criterion (AICc) and the relative Akaike weight. The symbol “+” indicates that the effect was included in the selected model.

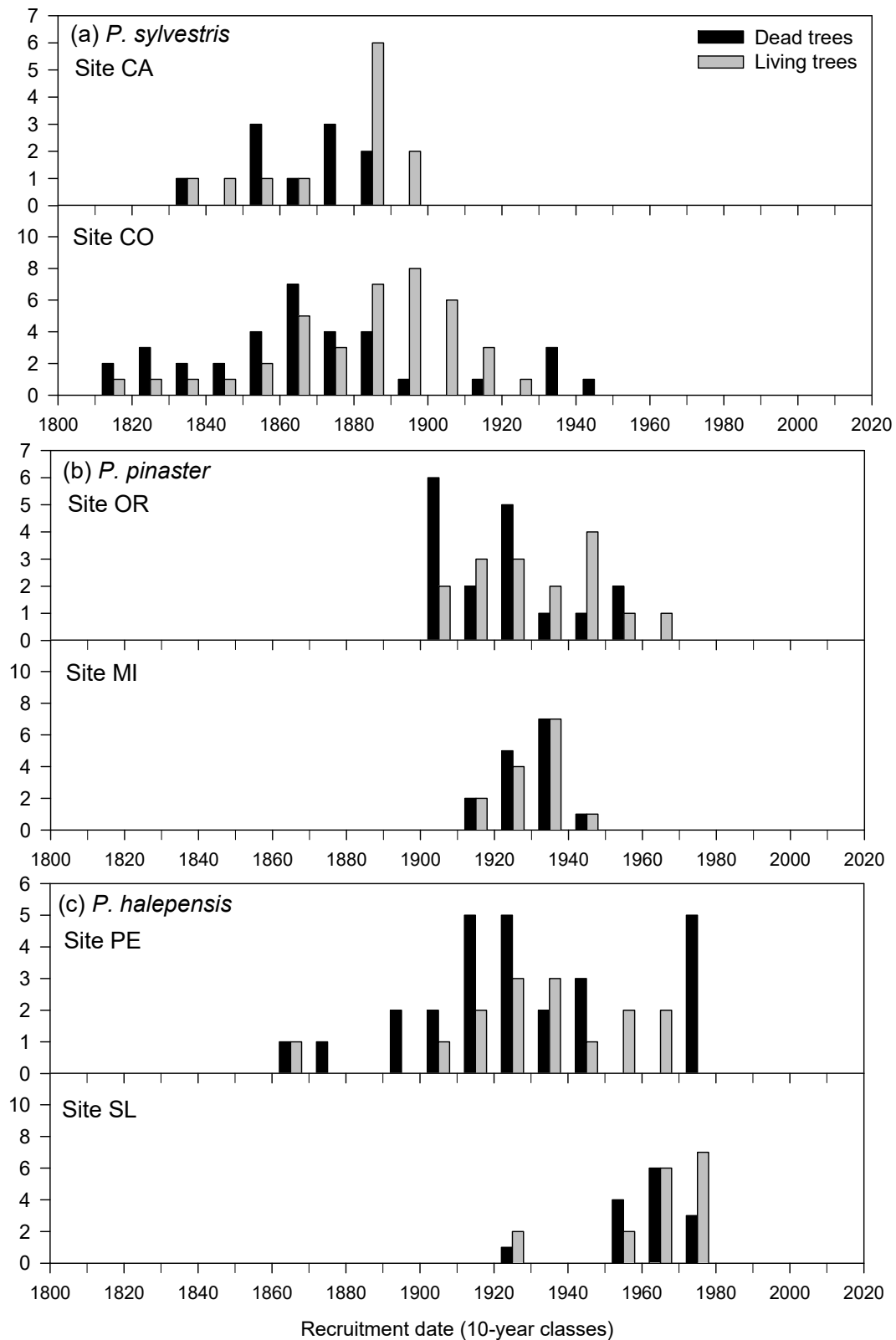
Site	Intercept	Dbh	SPEI	Status	year	SPEI x status	Status x year	$\Delta\text{AICc}$	Akaike weight
CA	-1.17	0.01	0.09	+	0.001	+	+	1.59	0.30
CO	5.15		0.13	+	0.002	+	+	0.00	0.97
MI	5.50	0.02	0.06	+	0.003	+	+	0.00	1.00
OR	5.44	0.01	0.09	+	0.002	+		0.00	0.44
PE	20.15		0.06	+	-0.010	+		0.34	0.18
SL	10.60	0.01	0.05	+	-0.005	+	+	0.27	0.47

**Table S3.** Estimated differences in the interactions between basal area increment (BAI) and time (year) or the SPEI drought index between living and dead trees in the study sites. The columns show the estimated coefficient, its standard error (SE) and the significance level ( $p$ ).

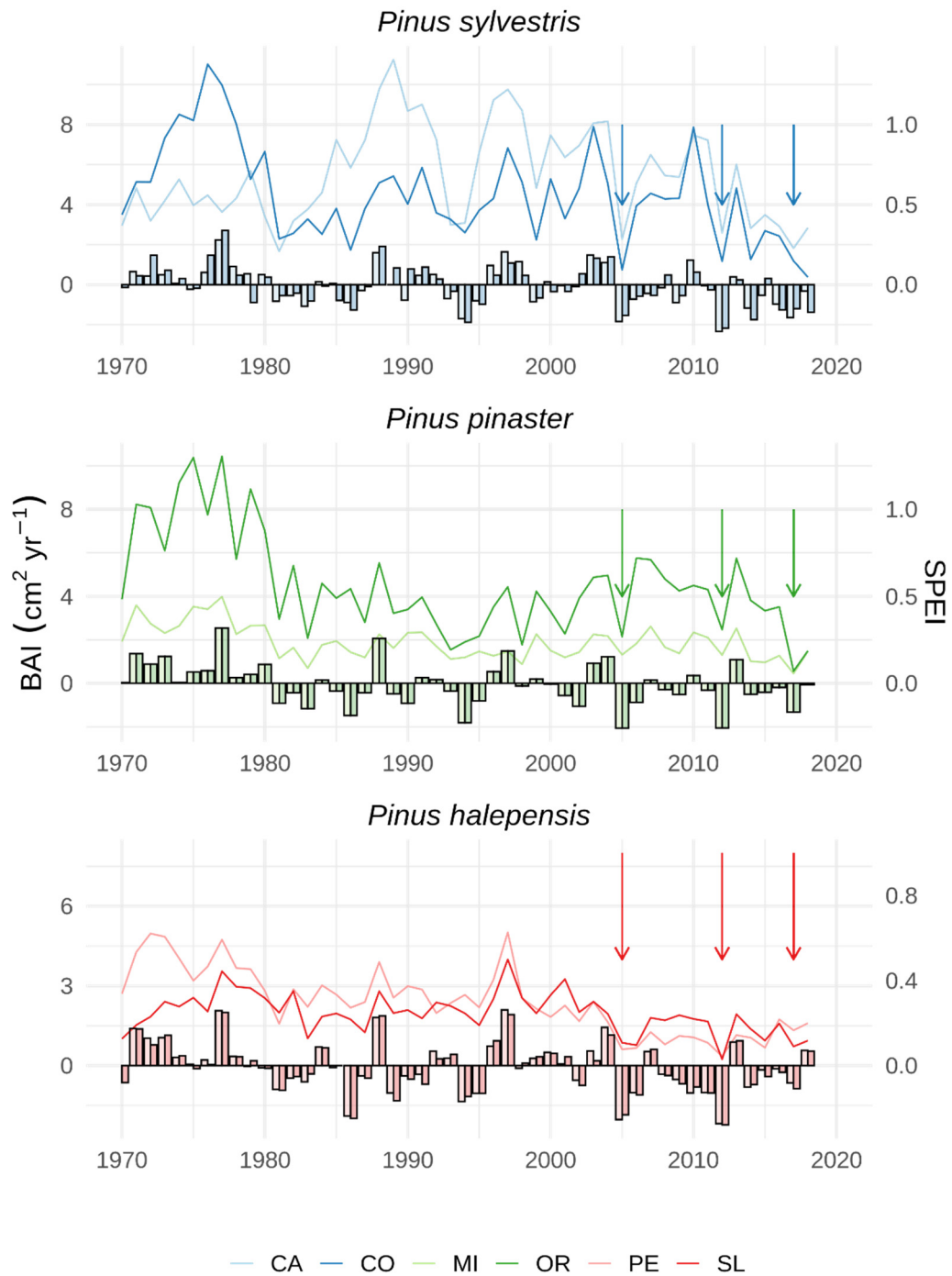
Contrast D-ND	Species	Site	Estimate	SE	$p$
BAI x Year	<i>P. sylvestris</i>	CA	-6.39	1.63	<0.001
		CO	-2.72	0.83	0.001
	<i>P. pinaster</i>	OR	0.81	0.95	0.391
		MI	-1.79	0.44	<0.001
	<i>P. halepensis</i>	PE	-0.96	1.39	0.492
		SL	-14.2	1.44	<0.001
	All sites	–	-5.98	0.54	<0.001
BAI x SPEI	<i>P. sylvestris</i>	CA	-0.003	0.005	0.519
		CO	-0.012	0.004	0.001
	<i>P. pinaster</i>	OR	-0.007	0.004	0.043
		MI	-0.014	0.003	<0.001
	<i>P. halepensis</i>	PE	-0.003	0.008	0.122
		SL	-0.024	0.004	<0.001
	All sites	–	-0.012	0.002	<0.001



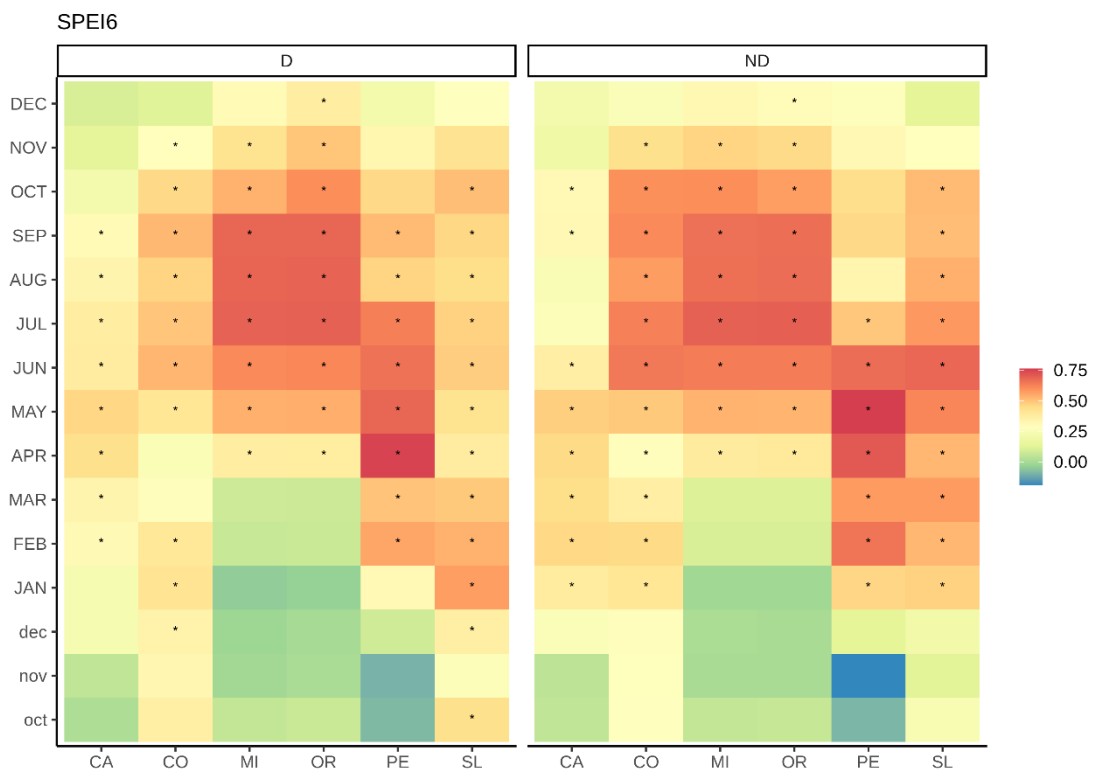
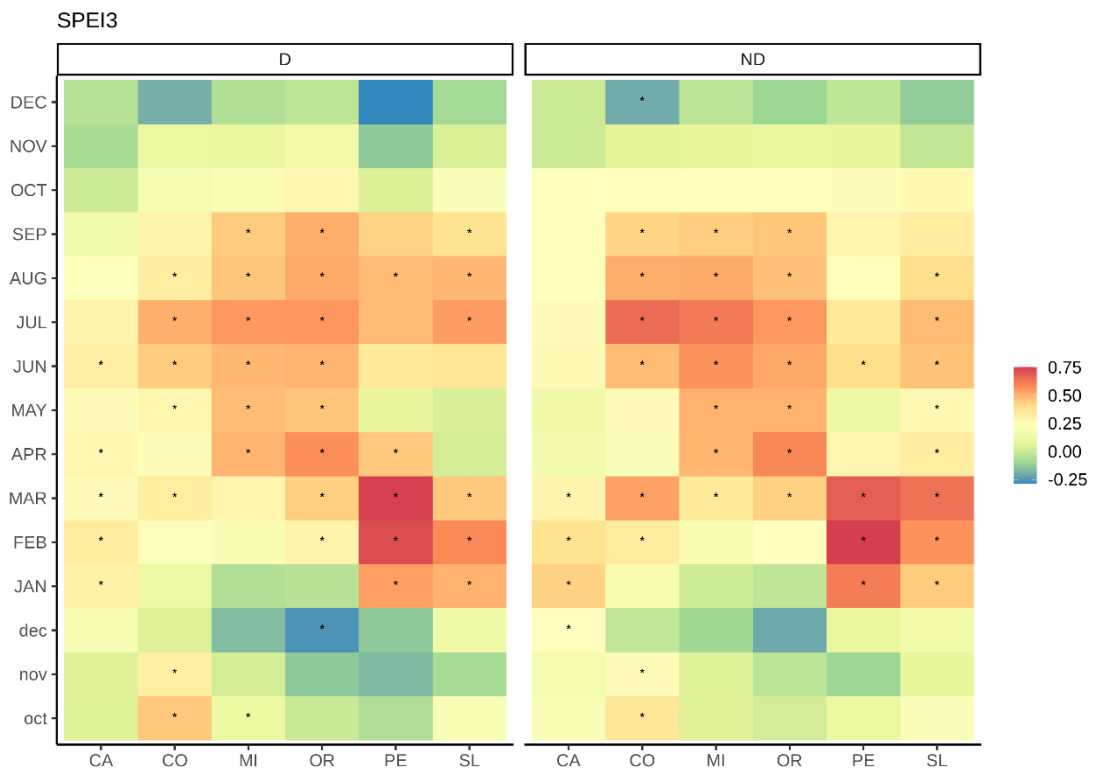
**Figure S1.** Location of the eight sampled sites (tree icons) in north-eastern Spain (see sites' coordinates in Table 1). Pictures showed (a) dead and (b) surviving *P. pinaster* trees in Orera and Miedes sites and (c) a zoom-in on the study area in Spain. Pine species are defined by labels' colours: *P. sylvestris* blue, *P. pinaster* green, and *P. halepensis* red. Sites' abbreviations are: HE, Hereña; CA, Calomarde; CO, Corbalán; MI, Miedes; OR, Orera; MR, Mora de Rubielos; PE, Peñaflo; and SL, Sierra de Luna.

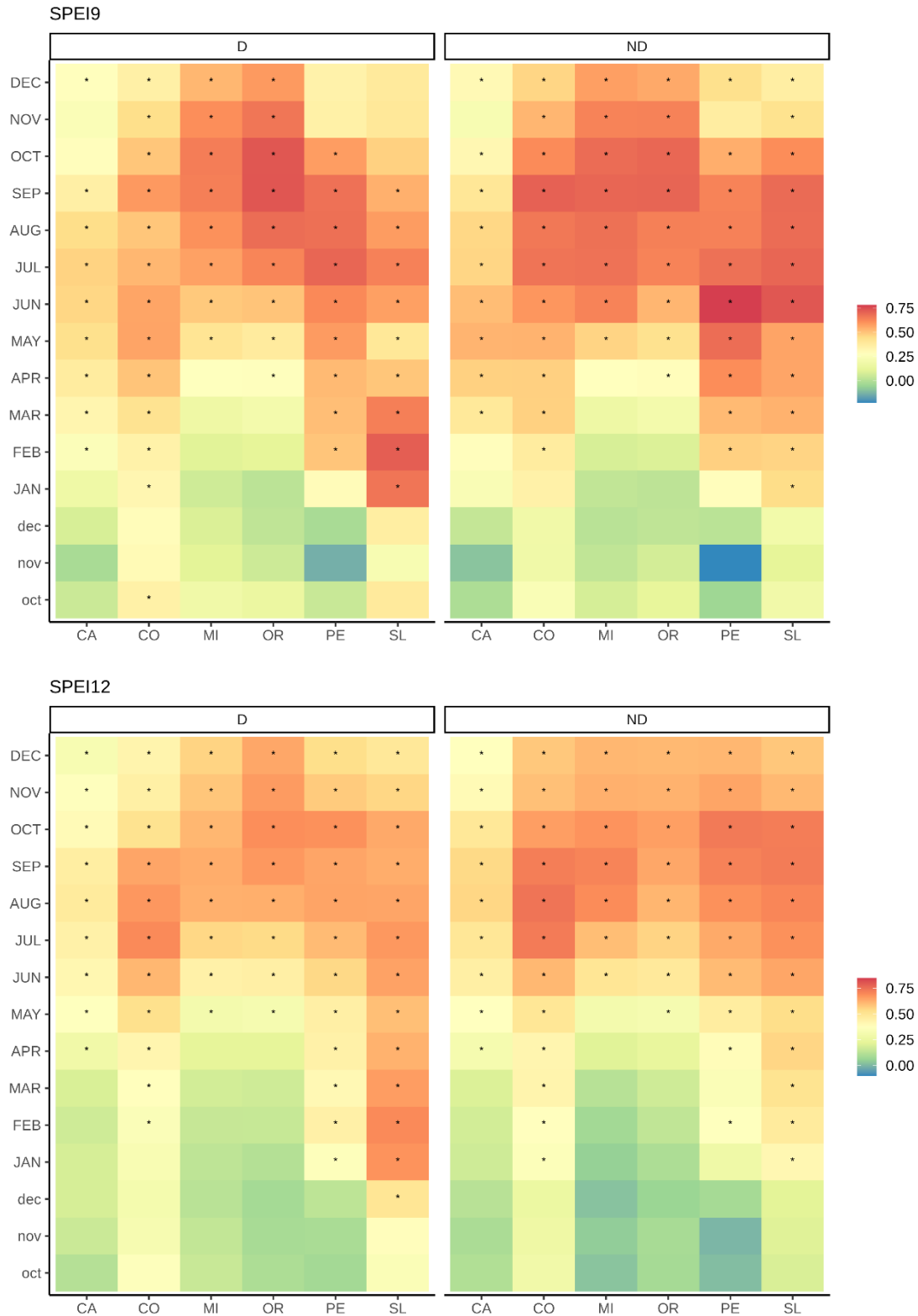


**Figure S2.** Recruitment histograms of dead and living trees considering 10-year classes. The y-axis represents the number of individuals. Sites are: CA (Calomarde), CO (Corbalán), OR (Orera), MI (Miedes), PE (Peñaflor) and SL (Sierra Luna).



**Figure S3.** Basal area increment (lines) and SPEI values (columns) in the six study sites according to study species. Note that the SPEI values are the same for the two nearby *P. pinaster* sites. Arrows show the 2005, 2012 and 2017 droughts. Sites are: CA (Calomarde), CO (Corbalán), MI (Miedes), OR (Orera), PE (Peñaflor) and SL (Sierra Luna).





**Figure S4.** Pearson correlations (color scale) obtained by relating the detrended basal area increment series and the SPEI drought index in six study sites (x axes). Correlations were calculated from previous October (oct) to current December (DEC) considering 3- (SPEI3), 6- (SPEI6), 9- (SPEI9) and 12-month (SPEI12) SPEI values. Significant correlations ( $p < 0.05$ ) are indicated with a dot (.). Sites are: CA (Calomarde), CO (Corbalán), MI (Miedes), OR (Orera), PE (Peñaflor) and SL (Sierra Luna).