Supplementary Material:

Table S1. Summary of sample size for site-level and regional chronologies, and the reasons for which trees were removed from the regional chronologies.

Site	Trees cored	Highly correlated at site level	Health status adjusted	Low correlations	Regional chronology
Healthy	196	131	-11	-21	99
Declining	97	73	+11	-20	64
Dead	96	69	0	-12	57
Total	389	273		-53	220

Table S2. Characteristics of the site level ring width chronologies. Mean series intercorrelation and sensitivity are for the full length of the chronology.

Site	n	Full length of chronology	$n \geq 10$ (year)	Mean length of series	Mean series intercorrelation	Mean sensitivity
1	16	1431-2015	1797	229.8	0.374	0.272
2	16	1287-2015	1805	307.6	0.373	0.308
3	21	1112-2015	1734	328.1	0.391	0.263
4	26	1500-2013	1575	356.8	0.461	0.281
5	21	1378-2015	1780	223.6	0.348	0.247
6	22	1324-2015	1840	223.3	0.342	0.253
7	22	1282-2015	1639	345.6	0.386	0.280
8	23	1380-2015	1683	338.4	0.366	0.270
9	28	1562-2013	1726	241.8	0.363	0.257
10	20	1515-2013	1784	254.9	0.361	0.273
11	22	1252-2015	1723	288.2	0.414	0.278
12	16	1440-2015	1817	293.4	0.376	0.259
13	23	1472-2015	1734	287.7	0.384	0.236

*Chronologies for sites 4, 9 and 11 were cut off in the 1500s to exclude sections with low correlations.

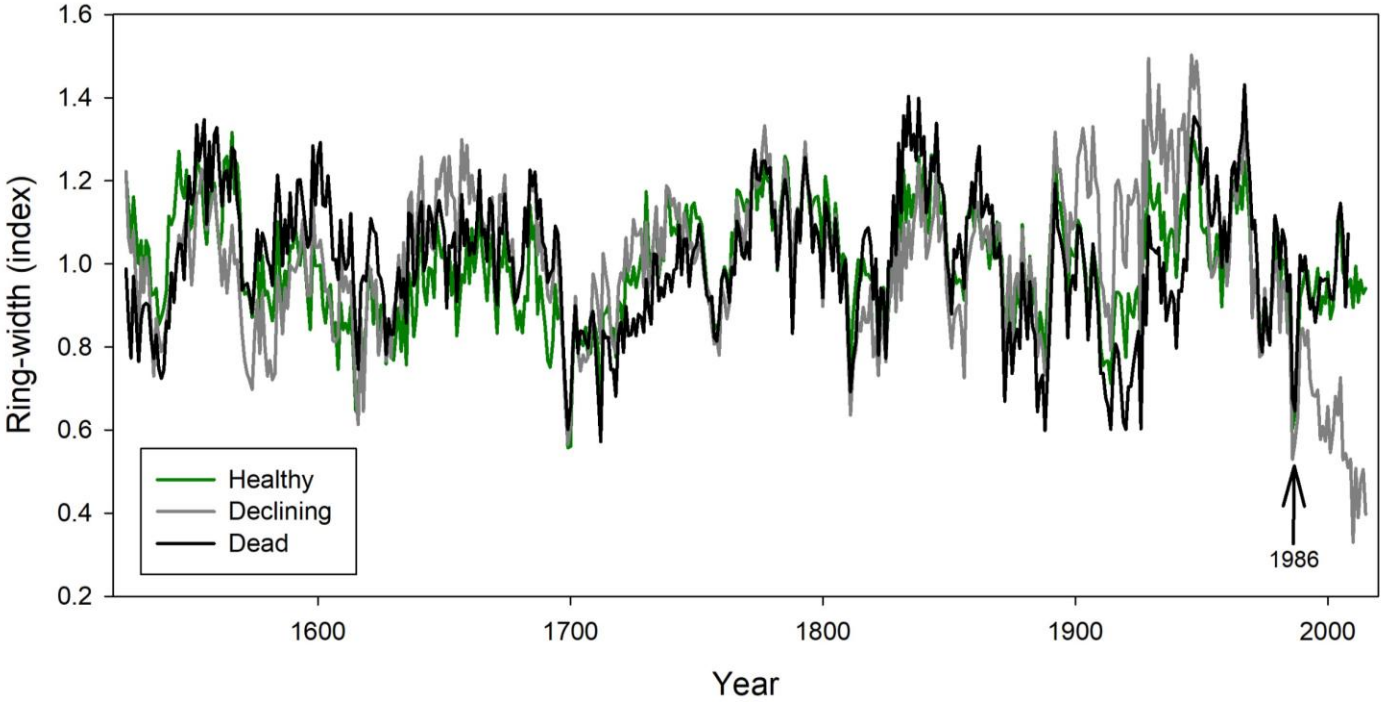


Figure S1. Ring width index of standard chronologies for healthy (green), declining (grey) and dead (black) trees, from 1524 to 2015, beginning when all three chronologies had ≥10 samples (n = 99, 64 and 57 for the healthy, declining and dead groups respectively).

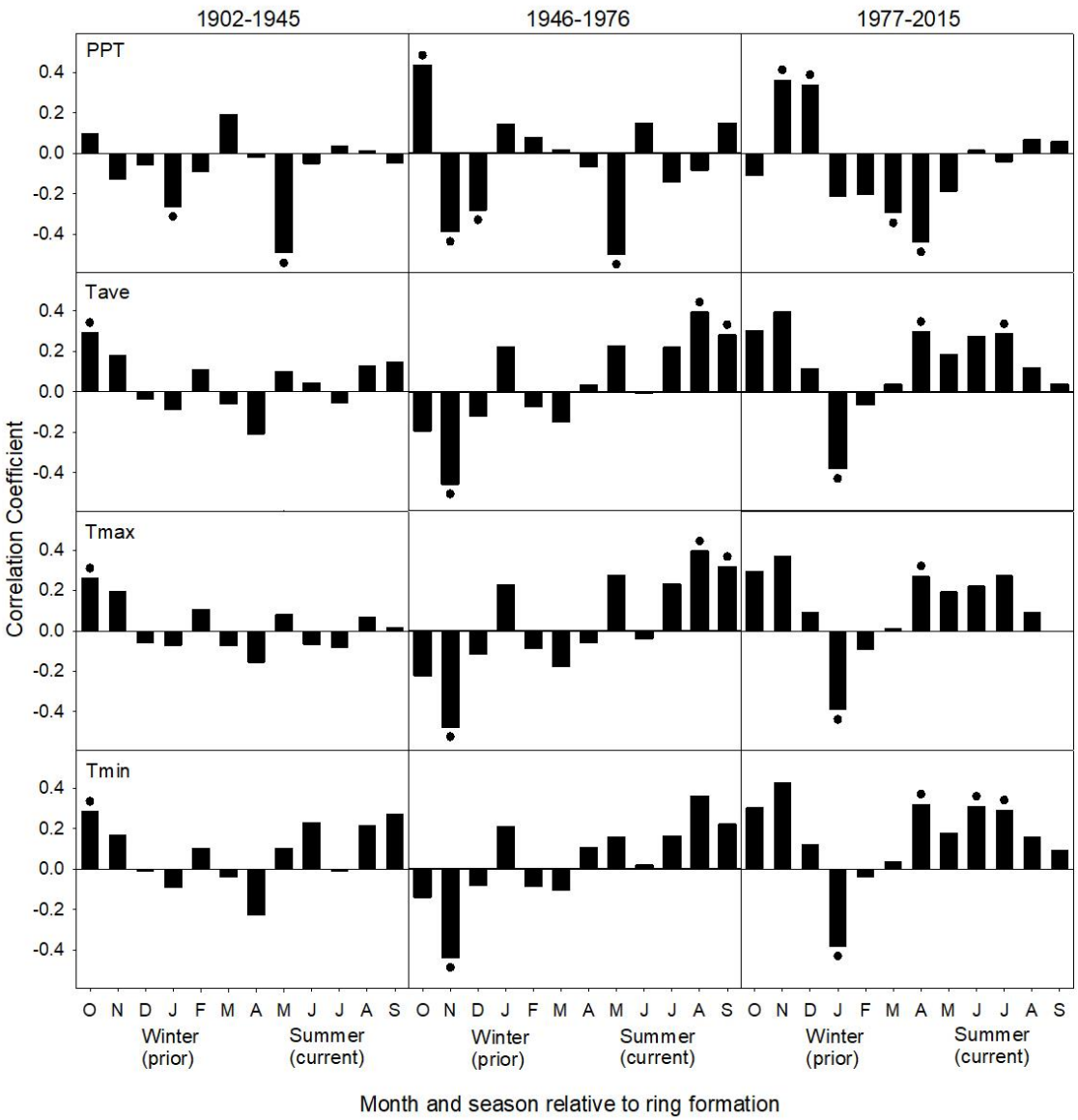


Figure S2. Correlation between monthly average precipitation (PPT), monthly mean temperature (Tave), monthly maximum temperature (Tmax), monthly minimum temperature (Tmin) and the residual chronology for the 'healthy' group, over the time periods 1902-1945 (left), 1946-1976 (middle) and 1977-2015 (right). Bars are the correlation coefficients, a dot indicates significance (α=0.05).

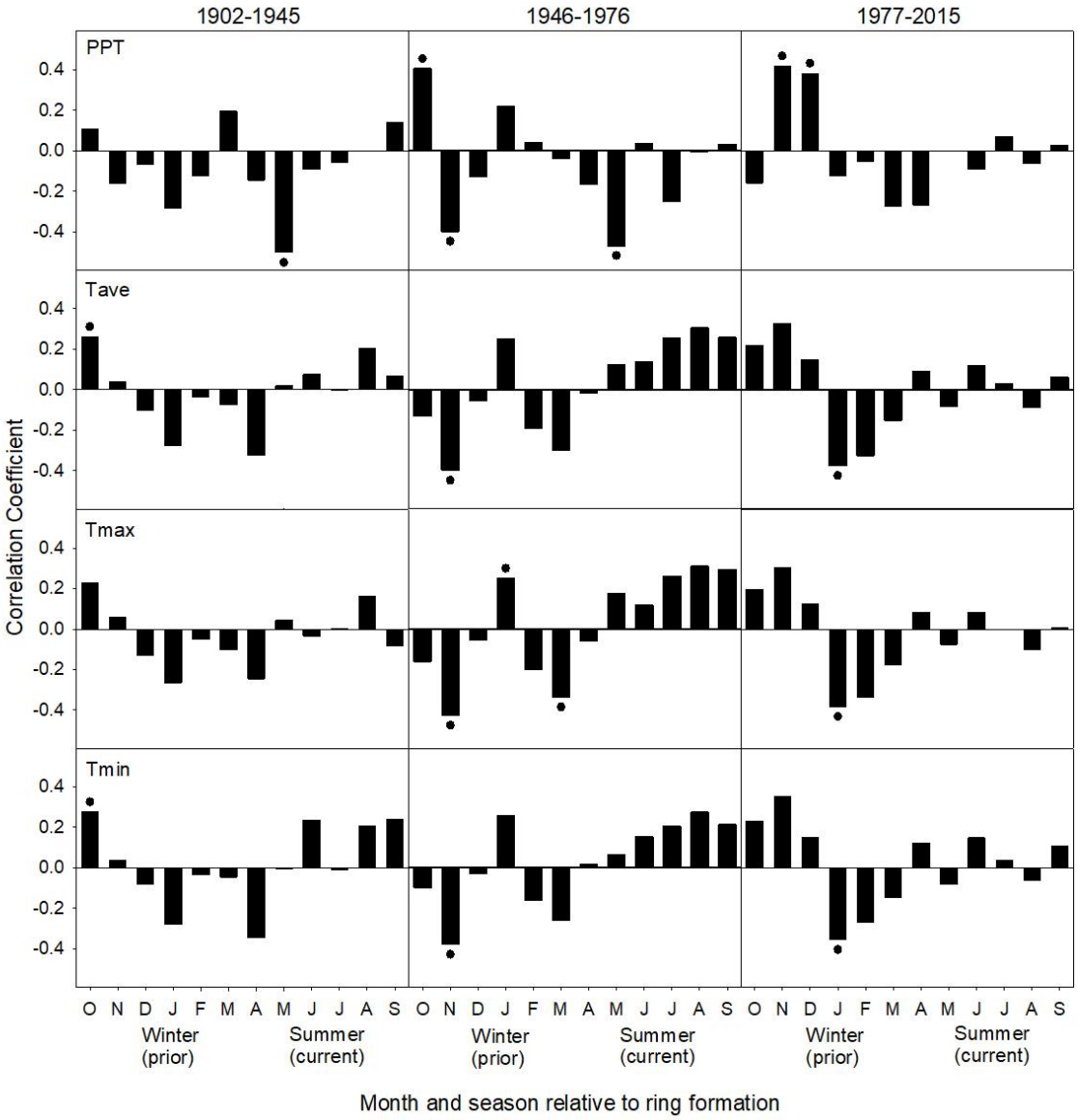


Figure S3. Correlation between monthly average precipitation (PPT), monthly mean temperature (Tave), monthly maximum temperature (Tmax), monthly minimum temperature (Tmin) and the residual chronology for the 'declining' group, over the time periods 1902-1945 (left), 1946-1976 (middle) and 1977-2015 (right). Bars are the correlation coefficients, a dot indicates significance (α=0.05).

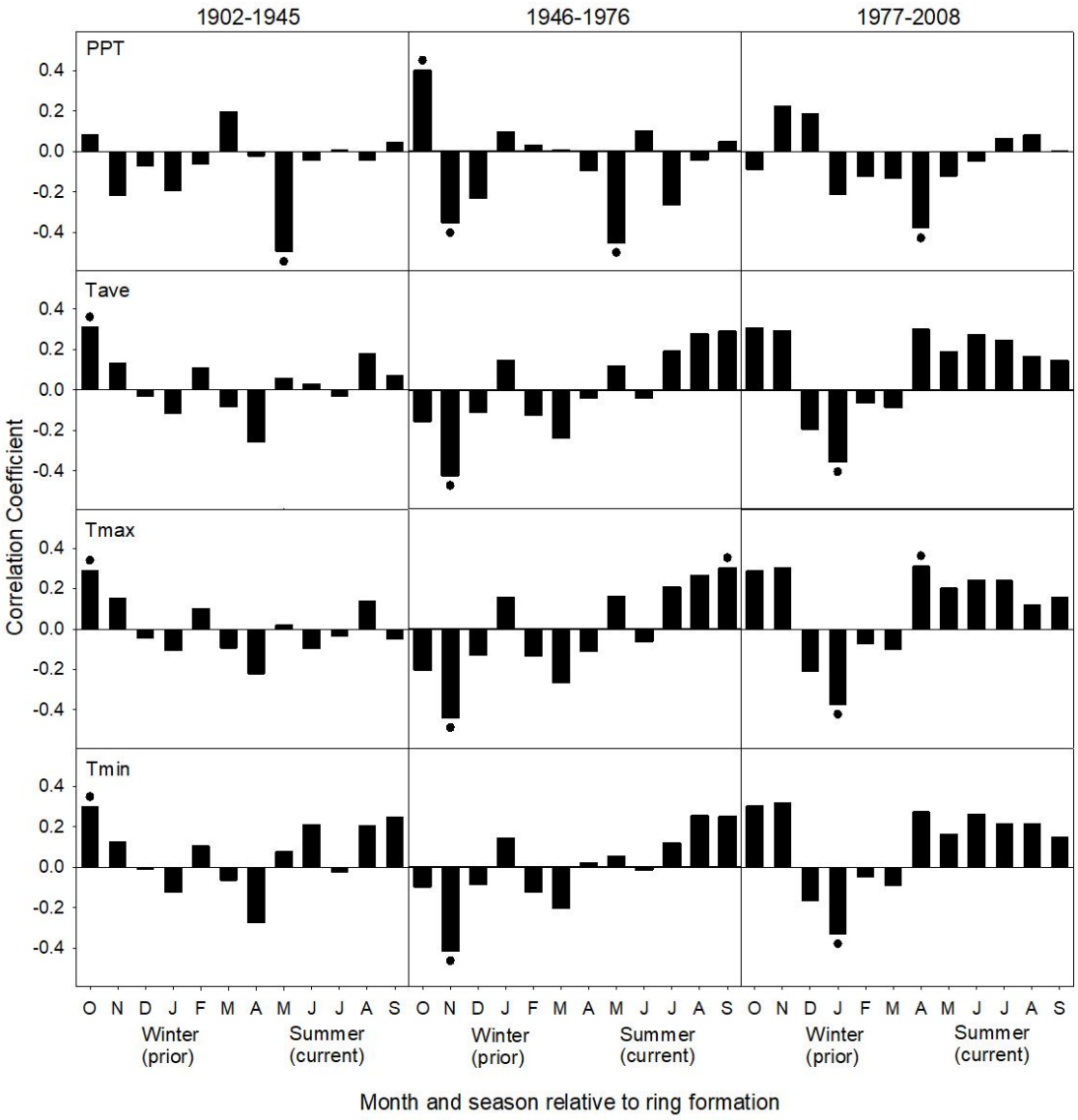


Figure S4. Correlation between monthly average precipitation (PPT), monthly mean temperature (Tave), monthly maximum temperature (Tmax), monthly minimum temperature (Tmin) and the residual chronology for the 'dead' group, over the time periods 1902-1945 (left), 1946-1976 (middle) and 1977-2015 (right). Bars are the correlation coefficients, a dot indicates significance (α=0.05).