

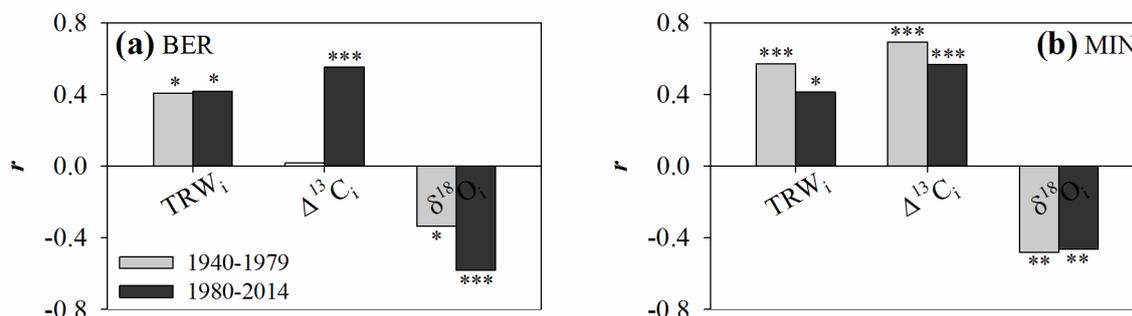
Supplementary material


Figure S1. Changes in tree responses to seasonal drought stress for BER (a) and MIN (b) over the two halves of the study period (1940–1979 and 1980–2014). The relationships with climate are based on bootstrapped correlations between indexed tree-ring data (TRW_i , $\Delta^{13}C_i$ and $\delta^{18}O_i$) corresponding to each site and May–August Standardized Precipitation-Evapotranspiration Index (SPEI4). Asterisks denote significance at: *, $P < 0.05$; **, $P < 0.01$; ***, $P < 0.001$.

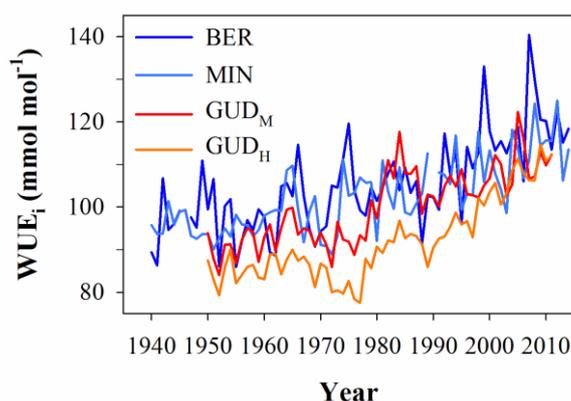


Figure S2. Long-term evolution of intrinsic water-use efficiency (WUE_i) of four Scots pine stands located in the forest-steppe zone of Central Siberia (BER, cold-dry; MIN, cold-moist) and in sub-Mediterranean Eastern Spain (GUD_L , warm-dry; GUD_H , warm-moist).

Table S1. Significance of fixed effects of linear mixed models with intrinsic water-use efficiency (WUE_i) explained as a function of Region (Central Siberia, Eastern Spain), Site (dry, moist), atmospheric CO_2 concentration (C_a) and growing season water deficit (WD; potential evapotranspiration exceeding precipitation). Significant effects are indicated as follows: *, $P < 0.05$; **, $P < 0.01$; ***, $P < 0.001$. Abbreviation: DF, degrees of freedom.

Fixed effect	DF (numerator)	DF (denominator)	F-value	P-value
Region	1	163	0.03	0.857
Site	1	163	5.43	0.021*
Region × Site	1	163	16.14	<0.001***
C_a	1	163	140.49	<0.001***
C_a × Region	1	163	0.06	0.799
C_a × Site	1	163	4.21	0.042*
C_a × Region × Site	1	163	17.32	<0.001***
WD	1	163	38.23	<0.001***

WD × Region	1	163	9.40	0.003**
WD × Site	1	163	0.08	0.773
WD × Region × Site	1	163	0.51	0.476

Table S2. Significance of fixed effects of linear mixed models with basal area increment (logBAI) explained as a function of Region (Central Siberia, Eastern Spain), Site (dry, moist) and intrinsic water-use efficiency (WUE_i). Significant effects are indicated as follows: *, $P < 0.01$; **, $P < 0.001$. Abbreviation: DF, degrees of freedom.

Fixed effect	DF (numerator)	DF (denominator)	F-value	P-value
Region	1	4220	13.06	<0.001***
Site	1	4220	9.66	0.002**
Region × Site	1	4220	0.21	0.646
WUE	1	4220	34.61	<0.001***
WUE × Region	1	4220	2.33	0.127
WUE × Site	1	4220	11.04	<0.001***
WUE × Region × Site	1	4220	0.09	0.771