

Table S1. Info of the valid FLUXNET sites in this study. The details regarding the codes of the climate and plant types are provided in Table 1.

Site name	Latitude	Longitude	Climate type	Plant type	Site-years number
US-Blo	38.9	-120.6	Csa	ENF	6
DE-Tha	51.0	13.6	Cfb	ENF	7
NL-Loo	52.2	5.7	Cfb	ENF	7
IT-Ren	46.6	11.4	Dfb	ENF	6
FI-Hyy	61.8	24.3	Dfc	ENF	6
FI-Sod	67.4	26.6	Dfc	ENF	7
US-MMS	39.3	-86.4	Cfa	DBF	6
DE-Hai	51.1	10.5	Cfb	DBF	7
DK-Sor	55.5	11.6	Cfb	DBF	7
FR-Hes	48.7	7.1	Cfb	DBF	6
US-Ha1	42.5	-72.2	Dfb	DBF	6
US-WCr	45.8	-90.1	Dfb	DBF	7
BE-Vie	50.3	6.0	Cfb	MF	7

Table S2. Variations in seasonal WUE with the phenological factors for each PFT through the panel analysis. The data denote regression coefficients (standard error) of panel analysis between WUE and phenological factors. NS denotes no significant ($P \geq 0.05$), and other coefficients are all significant ($P < 0.05$). The regression coefficients ($\text{g C m}^{-2} \text{ mm}^{-1} 10\text{-day}^{-1}$) are calculated in spring (March-May), summer (June-August) and autumn (September-November), respectively.

PFT	WUE _{Spring} SOS	WUE _{Summer} SOS	WUE _{Autumn} EOS	PFT	WUE _{Spring} SOS	WUE _{Summer} SOS	WUE _{Autumn} EOS
B-SHR	-0.03 (0.01)	NS	0.09 (0.02)	C3-GRA	-0.07 (<0.01)	-0.01 (<0.01)	0.06 (0.01)
B-GRA	-0.07 (<0.01)	-0.07 (0.01)	0.06 (<0.01)	C3-CRO	-0.08 (<0.01)	0.02 (<0.01)	0.11 (<0.01)
B-CRO	-0.05 (0.01)	NS	0.04 (0.01)	D1-ENF	-0.18 (<0.01)	-0.01 (<0.01)	0.11 (0.01)
C1-ENF	-0.06 (<0.01)	NS	0.07 (0.01)	D1-DBF	-0.27 (0.01)	0.10 (0.01)	0.13 (0.02)
C1-MF	-0.06 (0.01)	NS	0.03 (0.01)	D1-MF	-0.27 (<0.01)	0.06 (<0.01)	0.18 (<0.01)
C1-WSA	NS	0.04 (0.01)	NS	D1-GRA	-0.11 (<0.01)	-0.10 (<0.01)	0.08 (<0.01)
C1-GRA	-0.10 (0.01)	-0.04 (0.01)	0.09 (0.01)	D1-CRO	-0.15 (<0.01)	0.01 (<0.01)	0.12 (<0.01)
C1-CRO	-0.03 (0.01)	NS	NS	D2-ENF	-0.20 (<0.01)	0.01 (<0.01)	0.22 (<0.01)
C2-EBF	-0.02 (<0.01)	-0.01 (<0.01)	0.03 (<0.01)	D2-DNF	-0.33 (<0.01)	0.08 (<0.01)	0.18 (<0.01)
C2-DBF	NS	0.02 (0.01)	-0.06 (0.01)	D2-MF	-0.29 (<0.01)	0.04 (<0.01)	0.27 (<0.01)
C2-MF	-0.02 (<0.01)	-0.01 (<0.01)	0.04 (<0.01)	D2-SHR	-0.14 (<0.01)	-0.15 (<0.01)	0.17 (<0.01)
C2-WSA	-0.03 (<0.01)	-0.01 (<0.01)	0.02 (<0.01)	D2-WSA	-0.28 (<0.01)	-0.05 (<0.01)	0.24 (<0.01)
C2-GRA	-0.02 (0.01)	NS	0.03 (0.02)	D2-GRA	-0.11 (<0.01)	-0.04 (<0.01)	0.126 (<0.01)
C2-CRO	NS	0.02 (<0.01)	0.04 (<0.01)	D2-CRO	-0.25 (0.01)	0.02 (0.01)	0.21 (0.01)
C3-ENF	-0.07 (<0.01)	-0.02 (<0.01)	0.05 (0.01)	E-SHR	-0.07 (<0.01)	-0.13 (<0.01)	0.12 (<0.01)
C3-DBF	-0.03 (0.01)	0.06 (0.01)	0.03 (0.02)	E-GRA	-0.04 (<0.01)	-0.05 (<0.01)	0.06 (<0.01)
C3-MF	-0.07 (<0.01)	0.01 (<0.01)	0.06 (<0.01)				