Table S1. The range of leaf temperature (°C) in the photosynthetic measurement at high (HL) and low (LL) latitude sites.

Year	Month	HL	LL
2011			
	Jun	10–25	–
	Jul	15–30	–
	Aug	20–30	–
	Sep	10–25	–
	Oct	10–25	–
2012			
	Jun	10–25	20–30
	Jul	20–30	–
	Aug	20–35	20–35
	Sep	20–30	–
	Oct	15–25	–
2013			
	Jun	–	20–30
	Jul	–	–
	Aug	–	20–30
	Sep	–	–
	Oct	–	10–25

Table S2. Summary of two-way analysis of deviance for the effects of site and warming treatment and their interactions on leaf characteristics. Individual trees are incorporated as a random factor. Measurements were made in August 2012. *F* values with significance are shown (**P* < 0.05; ***P* < 0.01; ****P* < 0.001). LMA, leaf mass per unit area; N_{mass}, leaf nitrogen concentration per unit mass; N_{area}, leaf nitrogen concentration per unit area.

Factor	df	LMA	N_{mass}	N_{area}
Site (S)	1	1.49	0.05	0.16
Treatment (T)	1	13.0***	0.58	5.44*
S×T	1	42.4***	0.50	34.6***

Table S3. Seasonal changes in CO_2 assimilation rate at 20°C (A_{20}) and at 25°C (A_{25}) in canopy leaves of *Quercus serrata* at high (HL) and low (LL) latitude sites. Leaves were exposed to either naturally changing temperature conditions (control) or experimental warming with open-top canopy chambers (OTCC). Means ± standard deviation are shown (n = 12). The unit is μmol m^{-2} s^{-1}.

		A_{20}	HL		LL		A_{25}	HL		LL	
Year	Month		Control	OTCC	Control	OTCC		Control	OTCC	Control	OTCC
2011											
	Jun		9.06 ± 1.80	10.5 ± 1.28	–	–		9.01 ± 1.43	11.1 ± 1.68	–	–
	Jul		13.5 ± 1.48	12.7 ± 2.75	–	–		11.8 ± 1.42	12.4 ± 2.30	–	–
	Aug		12.7 ± 1.29	11.5 ± 1.49	–	–		12.4 ± 1.44	13.4 ± 1.59	–	–
	Sep		11.4 ± 1.19	12.4 ± 1.08	–	–		10.4 ± 1.29	11.6 ± 1.08	–	–
	Oct		9.36 ± 1.32	10.2 ± 1.21	–	–		8.06 ± 1.38	9.60 ± 1.42	–	–
2012											
	Jun		9.03 ± 0.97	10.9 ± 1.80	11.7 ± 1.18	11.5 ± 2.37		7.94 ± 1.43	9.93 ± 2.06	12.9 ± 1.46	12.5 ± 2.27
	Jul		15.1 ± 1.12	14.2 ± 1.20	–	–		14.4 ± 1.51	15.2 ± 1.05	–	–
	Aug		12.6 ± 1.45	12.9 ± 1.67	14.2 ± 1.85	13.3 ± 1.30		14.3 ± 1.35	15.2 ± 1.15	14.4 ± 1.42	13.8 ± 1.18
	Sep		12.7 ± 1.62	12.2 ± 1.55	–	–		12.5 ± 1.31	13.3 ± 0.98	–	–
	Oct		10.3 ± 1.55	10.3 ± 1.60	–	–		9.29 ± 1.44	9.88 ± 1.24	–	–
2013											
	Jun		–	–	16.3 ± 1.22	14.3 ± 1.83		–	–	16.7 ± 1.42	16.3 ± 2.01
	Jul		–	–	–	–		–	–	–	–
	Aug		–	–	15.2 ± 0.92	14.0 ± 1.03		–	–	15.3 ± 1.45	14.5 ± 1.46
	Sep		–	–	–	–		–	–	–	–
	Oct		–	–	9.01 ± 1.39	9.19 ± 1.04		–	–	8.76 ± 1.49	8.06 ± 0.87

Table S4. Seasonal changes in the optimal temperature that maximizes photosynthetic rate (T_{opt}), CO_2 assimilation rate at the optimum temperature (A_{max}) and spread of temperature response parabola (b) in canopy leaves of *Quercus serrata* at high (HL) and low (LL) latitude sites. Leaves were exposed to either naturally changing temperature conditions (control) or experimental warming with open-top canopy chambers (OTCC) (n = 1). Unit of T_{opt}, A_{max} and b are °C, μmol m^{-2} s^{-1} and non dimension, respectively.

		T_{opt}	HL		LL		A_{max}	HL		LL		b	HL		LL	
Year	Month		Control	OTCC	Control	OTCC		Control	OTCC	Control	OTCC		Control	OTCC	Control	OTCC
2011																
	Jun		–	24.7	–	–		–	11.1	–	–		–	0.0199	–	–
	Jul		19.8	23.7	–	–		12.8	12.7	–	–		0.0155	0.0274	–	–
	Aug		21.2	25.5	–	–		12.8	13.4	–	–		0.0268	0.0717	–	–
	Sep		20.7	21.0	–	–		11.2	12.4	–	–		0.0359	0.0379	–	–
	Oct		16.5	19.5	–	–		9.19	10.1	–	–		0.0160	0.0181	–	–
2012																
	Jun		17.8	19.8	24.5	25.8		9.51	10.9	12.8	12.8		0.0323	0.0301	0.0650	0.0470
	Jul		20.1	25.3	–	–		15.1	15.1	–	–		0.0160	0.0354	–	–
	Aug		26.6	27.0	25.5	25.1		14.1	14.8	14.6	13.6		0.0556	0.0539	0.0317	0.0155
	Sep		22.3	26.1	–	–		12.7	13.3	–	–		0.0221	0.0304	–	–
	Oct		18.3	21.0	–	–		10.3	10.3	–	–		0.0290	0.0320	–	–
2013																
	Jun		–	–	23.5	26.2		–	–	16.8	16.3		–	–	0.0457	0.0746
	Jul		–	–	–	–		–	–	–	–		–	–	–	–
	Aug		–	–	23.0	24.5		–	–	15.3	14.4		–	–	0.0183	0.0200
	Sep		–	–	–	–		–	–	–	–		–	–	–	–
	Oct		–	–	17.3	18.4		–	–	9.39	9.36		–	–	0.0227	0.0491

Table S5. Seasonal changes in maximum rate of RuBP carboxylation at 20°C (V_{cmax20}) and at 25°C (V_{cmax25}) in canopy leaves of *Quercus serrata* at high (HL) and low (LL) latitude sites. Leaves were exposed to either naturally changing temperature conditions (control) or experimental warming with open-top canopy chambers (OTCC). Means ± standard deviation are shown (n = 12). The unit is µmol m^{-2} s^{-1}.

		V_{cmax20}	HL		LL		V_{cmax25}	HL		LL	
Year	Month		Control	OTCC	Control	OTCC		Control	OTCC	Control	OTCC
2011											
	Jun		27.2 ± 6.60	40.4 ± 7.50	–	–		35.5 ± 9.52	56.4 ± 12.9	–	–
	Jul		45.2 ± 8.11	43.8 ± 12.4	–	–		45.3 ± 11.0	54.7 ± 17.6	–	–
	Aug		35.0 ± 7.04	35.6 ± 4.99	–	–		44.8 ± 9.51	49.1 ± 6.58	–	–
	Sep		29.6 ± 4.43	36.8 ± 3.52	–	–		38.3 ± 5.44	48.6 ± 5.78	–	–
	Oct		24.7 ± 4.50	29.9 ± 3.33	–	–		28.3 ± 3.80	36.7 ± 6.12	–	–
2012											
	Jun		31.7 ± 3.68	37.5 ± 6.35	49.1 ± 6.39	41.7 ± 4.96		40.6 ± 6.23	49.4 ± 10.1	73.4 ± 12.2	70.2 ± 8.83
	Jul		53.8 ± 5.33	51.8 ± 4.18	–	–		73.5 ± 11.7	78.7 ± 11.0	–	–
	Aug		46.1 ± 7.70	45.7 ± 7.54	55.2 ± 10.2	51.6 ± 4.75		71.0 ± 8.66	76.6 ± 11.7	88.1 ± 13.9	80.3 ± 8.02
	Sep		43.5 ± 6.06	41.2 ± 5.42	–	–		58.5 ± 7.85	64.6 ± 9.92	–	–
	Oct		34.3 ± 7.16	35.9 ± 7.93	–	–		41.7 ± 9.65	45.0 ± 8.98	–	–
2013											
	Jun		–	–	59.9 ± 4.20	56.2 ± 7.32		–	–	84.9 ± 6.45	82.9 ± 7.81
	Jul		–	–	–	–		–	–	–	–
	Aug		–	–	54.7 ± 7.14	49.9 ± 4.24		–	–	77.2 ± 7.93	68.0 ± 5.88
	Sep		–	–	–	–		–	–	–	–
	Oct		–	–	25.7 ± 3.72	27.8 ± 4.35		–	–	33.0 ± 6.34	28.7 ± 2.98

Table S6. Seasonal changes in maximum rate of electron transport at 20°C (J_{max20}) and at 25°C (J_{max25}) in canopy leaves of *Quercus serrata* at high (HL) and low (LL) latitude sites. Leaves were exposed to either naturally changing temperature conditions (control) or experimental warming with open-top canopy chambers (OTCC). Means ± standard deviation are shown (n = 12). The unit is μmol m^{-2} s^{-1}.

		$J_{max\ 20}$	HL		LL		$J_{max\ 25}$	HL		LL	
Year	Month		Control	OTCC	Control	OTCC		Control	OTCC	Control	OTCC
2011											
	Jun		64.0 ± 14.2	78.2 ± 12.1	–	–		68.2 ± 13.5	90.3 ± 11.7	–	–
	Jul		87.0 ± 9.41	86.9 ± 16.6	–	–		92.5 ± 15.2	98.8 ± 22.9	–	–
	Aug		103 ± 9.25	99.3 ± 11.1	–	–		110 ± 14.2	113 ± 12.2	–	–
	Sep		101 ± 10.6	105 ± 7.73	–	–		107 ± 11.5	116 ± 7.81	–	–
	Oct		87.8 ± 11.5	92.5 ± 9.17	–	–		88.5 ± 13.9	101 ± 10.5	–	–
2012											
	Jun		73.2 ± 6.19	85.4 ± 11.8	90.8 ± 13.7	89.5 ± 17.5		90.1 ± 8.73	90.7 ± 15.1	117 ± 18.6	104 ± 18.2
	Jul		93.6 ± 11.7	94.9 ± 7.13	–	–		110 ± 12.5	110 ± 9.60	–	–
	Aug		102 ± 6.52	103 ± 8.81	104 ± 11.7	94.1 ± 8.45		122 ± 9.75	130 ± 10.5	129 ± 12.6	125 ± 11.5
	Sep		98.1 ± 11.1	96.3 ± 11.1	–	–		113 ± 13.6	115 ± 12.3	–	–
	Oct		87.2 ± 10.3	83.0 ± 7.62	–	–		91.8 ± 11.1	94.7 ± 13.3	–	–
2013											
	Jun		–	–	119 ± 9.08	110 ± 15.4		–	–	143 ± 11.2	135 ± 18.9
	Jul		–	–	–	–		–	–	–	–
	Aug		–	–	120 ± 7.40	112 ± 7.19		–	–	140 ± 11.3	124 ± 8.50
	Sep		–	–	–	–		–	–	–	–
	Oct		–	–	75.5 ± 13.4	71.7 ± 6.29		–	–	85.3 ± 12.8	74.5 ± 6.01

Table S7. Seasonal changes in dark respiration rate at 20°C (R_{dark20}) and at 25°C (R_{dark25}) in canopy leaves of *Quercus serrata* at high (HL) and low (LL) latitude sites. Leaves were exposed to either naturally changing temperature conditions (control) or experimental warming with open-top canopy chambers (OTCC). Means ± standard deviation are shown (n = 12). The unit is μmol m^{-2} s^{-1}.

		R_{dark20}	HL		LL		R_{dark25}	HL		LL	
Year	Month		Control	OTCC	Control	OTCC		Control	OTCC	Control	OTCC
2011											
	Jun		–	–	–	–		2.07 ± 0.53	2.45 ± 0.28	–	–
	Jul		–	–	–	–		1.47 ± 0.19	1.54 ± 0.25	–	–
	Aug		–	–	–	–		1.97 ± 0.36	2.26 ± 0.46	–	–
	Sep		–	–	–	–		1.96 ± 0.19	2.16 ± 0.27	–	–
	Oct		–	–	–	–		2.02 ± 0.31	2.21 ± 0.14	–	–
2012											
	Jun		1.77 ± 0.16	1.70 ± 0.19	1.31 ± 0.24	1.31 ± 0.17		2.55 ± 0.39	2.69 ± 0.43	2.21 ± 0.36	1.94 ± 0.27
	Jul		1.15 ± 0.28	1.16 ± 0.16	–	–		1.98 ± 0.19	2.05 ± 0.26	–	–
	Aug		0.89 ± 0.11	1.08 ± 0.16	1.13 ± 0.15	0.95 ± 0.18		1.66 ± 0.19	1.69 ± 0.12	1.97 ± 0.22	1.49 ± 0.24
	Sep		0.94 ± 0.14	1.04 ± 0.13	–	–		1.51 ± 0.17	1.55 ± 0.17	–	–
	Oct		0.87 ± 0.16	0.77 ± 0.14	–	–		1.32 ± 0.38	1.35 ± 0.22	–	–
2013											
	Jun		–	–	1.82 ± 0.16	1.72 ± 0.25		–	–	2.55 ± 0.15	2.19 ± 0.30
	Jul		–	–	–	–		–	–	–	–
	Aug		–	–	1.31 ± 0.28	1.44 ± 0.21		–	–	2.17 ± 0.26	2.18 ± 0.25
	Sep		–	–	–	–		–	–	–	–
	Oct		–	–	1.29 ± 0.27	1.56 ± 0.15		–	–	1.91 ± 0.18	1.84 ± 0.28

Table S8. Seasonal changes in intercellular CO_2 concentration at 20°C (C_{i20}) and at 25°C (C_{i25}) in canopy leaves of *Quercus serrata* at high (HL) and low (LL) latitude sites. Leaves were exposed to either naturally changing temperature conditions (control) or experimental warming with open-top canopy chambers (OTCC). Means ± standard deviation are shown (n = 12). The unit is µmol mol^{-1}.

		C_{i20}	HL		LL		C_{i25}	HL		LL	
Year	Month		Control	OTCC	Control	OTCC		Control	OTCC	Control	OTCC
2011											
	Jun		277 ± 20.5	254 ± 15.4	–	–		263 ± 18.3	247 ± 17.2	–	–
	Jul		267 ± 16.4	275 ± 17.8	–	–		247 ± 9.38	246 ± 12.1	–	–
	Aug		316 ± 16.4	317 ± 11.1	–	–		303 ± 12.4	306 ± 14.4	–	–
	Sep		290 ± 17.1	289 ± 15.2	–	–		283 ± 11.5	279 ± 17.1	–	–
	Oct		314 ± 12.8	302 ± 12.7	–	–		291 ± 10.6	278 ± 11.5	–	–
2012											
	Jun		259 ± 23.0	259 ± 16.7	248 ± 14.9	268 ± 12.7		224 ± 11.5	236 ± 14.0	244 ± 35.1	246 ± 22.2
	Jul		268 ± 11.6	257 ± 18.0	–	–		236 ± 21.7	247 ± 16.4	–	–
	Aug		259 ± 14.4	258 ± 11.1	248 ± 10.2	248 ± 18.2		242 ± 7.83	250 ± 8.67	230 ± 12.7	225 ± 9.92
	Sep		259 ± 8.32	258 ± 7.69	–	–		247 ± 13.4	250 ± 13.2	–	–
	Oct		243 ± 14.7	248 ± 16.6	–	–		237 ± 15.2	238 ± 11.5	–	–
2013											
	Jun		–	–	258 ± 2.91	256 ± 10.6		–	–	256 ± 7.93	256 ± 9.63
	Jul		–	–	–	–		–	–	–	–
	Aug		–	–	263 ± 13.8	265 ± 9.49		–	–	257 ± 6.26	261 ± 7.22
	Sep		–	–	–	–		–	–	–	–
	Oct		–	–	295 ± 13.7	295 ± 17.3		–	–	287 ± 7.55	299 ± 12.3

Table S9. Seasonal changes in stomatal conductance at 20°C (g_{s20}) and at 25°C (g_{s25}) in canopy leaves of *Quercus serrata* at high (HL) and low (LL) latitude sites. Leaves were exposed to either naturally changing temperature conditions (control) or experimental warming with open-top canopy chambers (OTCC). Means ± standard deviation are shown (n = 12). The unit is mol m^{-2} s^{-1}.

		g_{s20}	HL		LL		g_{s25}	HL		LL	
Year	Month		Control	OTCC	Control	OTCC		Control	OTCC	Control	OTCC
2011											
	Jun		0.101 ± 0.029	0.094 ± 0.031	–	–		0.090 ± 0.025	0.101 ± 0.022	–	–
	Jul		0.156 ± 0.035	0.166 ± 0.064	–	–		0.107 ± 0.023	0.115 ± 0.037	–	–
	Aug		0.305 ± 0.056	0.272 ± 0.079	–	–		0.234 ± 0.054	0.285 ± 0.081	–	–
	Sep		0.163 ± 0.033	0.188 ± 0.057	–	–		0.136 ± 0.029	0.152 ± 0.035	–	–
	Oct		0.176 ± 0.034	0.171 ± 0.037	–	–		0.108 ± 0.032	0.116 ± 0.035	–	–
2012											
	Jun		0.085 ± 0.018	0.107 ± 0.028	0.110 ± 0.028	0.130 ± 0.047		0.055 ± 0.011	0.080 ± 0.028	0.129 ± 0.049	0.122 ± 0.044
	Jul		0.182 ± 0.025	0.148 ± 0.030	–	–		0.129 ± 0.024	0.151 ± 0.029	–	–
	Aug		0.130 ± 0.032	0.133 ± 0.031	0.137 ± 0.029	0.128 ± 0.028		0.131 ± 0.018	0.152 ± 0.019	0.119 ± 0.013	0.108 ± 0.013
	Sep		0.134 ± 0.028	0.124 ± 0.026	–	–		0.117 ± 0.015	0.130 ± 0.014	–	–
	Oct		0.085 ± 0.012	0.092 ± 0.020	–	–		0.073 ± 0.010	0.081 ± 0.010	–	–
2013											
	Jun		–	–	0.194 ± 0.042	0.153 ± 0.031		–	–	0.196 ± 0.034	0.196 ± 0.054
	Jul		–	–	–	–		–	–	–	–
	Aug		–	–	0.177 ± 0.024	0.161 ± 0.025		–	–	0.168 ± 0.024	0.166 ± 0.032
	Sep		–	–	–	–		–	–	–	–
	Oct		–	–	0.128 ± 0.022	0.132 ± 0.024		–	–	0.113 ± 0.026	0.122 ± 0.024

Table S10. Seasonal changes in activation energy of maximal rate of carboxylation (E_{aV}), activation energy of electron transport rate (E_{aJ}), activation energy of dark respiration (E_{aR}) and temperature dependence of C_i (c) in canopy leaves of *Quercus serrata* at high (HL) and low (LL) latitude sites. Leaves were exposed to either naturally changing temperature conditions (control) or experimental warming with open-top canopy chambers (OTCC) (n = 1). The unit of activation energies and c is kJ mol^{-1} and µmol mol^{-1} ^{o}C^{-1}, respectively.

		E_{aV}	HL		LL		E_{aJ}	HL		LL		E_{aR}	HL		LL		c	HL		LL	
Year	Month		Control	OTCC	Control	OTCC		Control	OTCC	Control	OTCC		Control	OTCC	Control	OTCC		Control	OTCC	Control	OTCC
2011																					
	Jun		58.6	60.7	–	–		30.7	25.3	–	–		–	–	–	–		-1.94	-2.38	–	–
	Jul		36.5	47.9	–	–		17.9	22.6	–	–		–	–	–	–		-4.18	-5.20	–	–
	Aug		41.4	58.3	–	–		10.9	19.1	–	–		–	–	–	–		-2.46	-3.12	–	–
	Sep		45.5	52.3	–	–		25.9	24.3	–	–		–	–	–	–		-2.79	-2.14	–	–
	Oct		32.0	40.1	–	–		19.5	26.4	–	–		–	–	–	–		-2.28	-1.63	–	–
2012																					
	Jun		41.4	42.5	57.7	63.4		36.6	24.3	32.1	24.5		57.4	62.2	56.7	48.7		-7.08	-4.38	-4.99	-4.40
	Jul		46.9	53.1	–	–		33.5	27.5	–	–		63.7	67.2	–	–		-5.24	-2.22	–	–
	Aug		46.7	50.4	52.3	54.6		12.6	15.0	16.8	15.0		54.7	55.1	58.6	62.1		-2.98	-2.43	-2.61	-1.51
	Sep		50.6	52.6	–	–		16.9	22.6	–	–		59.5	59.6	–	–		-3.77	-2.05	–	–
	Oct		38.8	45.0	–	–		13.5	22.7	–	–		69.6	69.2	–	–		-2.12	-3.22	–	–
2013																					
	Jun		–	–	50.6	56.7		–	–	21.3	23.7		–	–	41.6	49.2		–	–	-1.82	-1.39
	Jul		–	–	–	–		–	–	–	–		–	–	–	–		–	–	–	–
	Aug		–	–	49.9	58.5		–	–	18.3	18.7		–	–	59.8	55.2		–	–	-1.87	-2.56
	Sep		–	–	–	–		–	–	–	–		–	–	–	–		–	–	–	–
	Oct		–	–	37.0	36.3		–	–	25.2	29.4		–	–	73.4	48.2		–	–	-2.66	-2.46