Supporting Information

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Table S1. Sample selection and species growth specifics

Species	Growth type	Canopy layer	Hydrological preference	No. of samples		CO_2 range (ppm)
				Subfossil	Collected	
Acer rubrum	BD	Upper	Cosmopolitan	23	17	308–387
Ilex cassine	BE	Middle	Moist/wet	39	49	290–387
Myrica cerifera	BE	Middle	Cosmopolitan	48	40	294–387
Osmunda regalis	BD	Lower	Moist	65	83	307–387
Pinus elliottii	NE	Upper	Moist	—	41	300–387
Pinus taeda	NE	Upper	Cosmopolitan	59	3	335–387
Quercus nigra	BD	Upper	Cosmopolitan	—	57	287–387
Quercus laurifolia	BD	Upper	Moist/wet	89	—	290–371
Taxodium distichum	ND	Upper	Wet	21	33	294–387

The *Acer rubrum*, *Ilex cassine*, *Myrica cerifera*, *Osmunda regalis*, and *Pinus taeda* subfossil material is extracted from a peat core taken in 1998 A.D. in a hardwood swamp forest near Gainesville, FL (Alligator Crossing: 29°39′35″N, 82°15′14″W) (1). Subfossil leaf fragments of *Taxodium distichum* and *Quercus laurifolia* are extracted from two peat cores taken in 1998 A.D. and 2002 A.D., respectively, in a cypress swamp forest of the Fakahatchee Strand Preserve State Park (25°95′N, 81°49′W) (2). For all cores age models are constructed with an accuracy of 2–5 y (1, 2). The herbarium samples, obtained from the University of Florida and State Park Headquarters District 4 herbaria, have been collected during the 19th and 20th century from various sites across Florida. Only leaves picked between August and January have been selected to ensure that leaves were fully developed. Self-collected material is available from 1998 A.D. onward. Details of the nine analyzed species, the origin and amount of samples, and the CO_2 range covered by the samples are given in Table S1. BD, broadleaved deciduous; BE, broadleaved evergreen; NE, needle-leaved evergreen; ND, needle-leaved deciduous; —, no material analyzed.

1. Wagner F, Dilcher DL, Visscher H (2005) Stomatal frequency responses in hardwood-swamp vegetation from Florida during a 60-year continuous CO2 increase. *Am J Bot* 92:690–695.
2. Donders TH, Wagner F, Van der Borg K, De Jong AFM, Visscher H (2004) A novel approach for developing high-resolution sub-fossil peat chronologies with 14C dating. *Radiocarbon* 46: 455–464.

Table S2. Linear regressions of maximum stomatal conductance g_{smax} (mol·m^{-2}·s^{-1}) vs. CO_2 (ppm)

Species	Function	CV(RMSE) (%)	r^2	*P*
Acer rubrum	$g_{smax} = -0.013 \cdot [CO_2] + 6.77$	14	0.45	0.01*
Ilex cassine	$g_{smax} = -0.004 \cdot [CO_2] + 2.59$	14	0.36	0.002*
Myrica cerifera	$g_{smax} = -0.006 \cdot [CO_2] + 3.72$	11	0.49	<0.001*
Osmunda regalis	$g_{smax} = -0.003 \cdot [CO_2] + 1.51$	20	0.24	0.01*
Pinus elliottii	$g_{smax} = -0.002 \cdot [CO_2] + 1.66$	8	0.36	0.02*
Pinus taeda	$g_{smax} = -0.016 \cdot [CO_2] + 7.41$	9	0.54	0.006*
Quercus laurifolia	$g_{smax} = -0.005 \cdot [CO_2] + 4.31$	12	0.21	0.03*
Quercus nigra	$g_{smax} = -0.016 \cdot [CO_2] + 8.65$	10	0.61	<0.001*
Taxodium distichum	$g_{smax} = -0.005 \cdot [CO_2] + 2.93$	10	0.58	0.006*

For easier interspecies comparison, the range of variability is normalized and presented as the variability coefficient of the root mean squared errors CV(RMSE), in %.

*All statistically significant regressions ($P < 0.05$) also have significantly different slopes.

Table S3. Stomatal density D (number of stomata $\cdot \text{mm}^{-2}$) vs. pore size a_{max} (μm^2)

Species	Function	r^2	P
Acer rubrum	$a_{max} = 0.019 \cdot [D] + 34.6$	0.07	0.09
	$\log10\, a_{max} = 0.278 \cdot [\log10\, D] + 0.9$	0.08	0.08
Ilex cassine	$a_{max} = 0.017 \cdot [D] + 72.6$	0.002	0.69
	$\log10\, a_{max} = 0.063 \cdot [\log10\, D] + 1.7$	0.002	0.66
Myrica cerifera	$a_{max} = -0.041 \cdot [D] + 55.9$	0.25	<0.001*
	$\log10\, a_{max} = -0.852 \cdot [\log10\, D] + 3.8$	0.27	<0.001*
Osmunda regalis	$a_{max} = -0.391 \cdot [D] + 246.9$	0.06	0.004*
	$\log10\, a_{max} = -0.161 \cdot [\log10\, D] + 2.6$	0.07	0.001*
Pinus elliottii	$a_{max} = -3.101 \cdot [D] + 736.3$	0.20	0.003*
	$\log10\, a_{max} = -0.406 \cdot [\log10\, D] + 3.5$	0.20	0.003*
Pinus taeda	$a_{max} = 0.171 \cdot [D] + 186.1$	0.01	0.42
	$\log10\, a_{max} = 0.197 \cdot [\log10\, D] + 1.9$	0.02	0.29
Quercus laurifolia	$a_{max} = -0.008 \cdot [\mathrm{D}] + 31.5$	0.06	0.02*
	$\log10\, a_{max} = -0.475 \cdot [\log10\, D] + 2.8$	0.06	0.02*
Quercus nigra	$a_{max} = -0.017 \cdot [D] + 97.2$	0.01	0.45
	$\log10\, a_{max} = -0.065 \cdot [\log10\, D] + 2.1$	0.003	0.68
Taxodium distichum	$a_{max} = -0.075 \cdot [D] + 106.5$	0.20	<0.001*
	$\log10\, a_{max} = -0.207 \cdot [\log10\, D] + 2.4$	0.20	<0.001*
Angiosperms	$a_{max} = -0.049 \cdot [\mathrm{D}] + 84.1$	0.42	<0.001*
	$\log10\, a_{max} = -0.724 \cdot [\log10\, D] + 3.6$	0.51	<0.001*
Conifers	$a_{max} = -1.995 \cdot [\mathrm{D}] + 598.9$	0.72	<0.001*
	$\log10\, a_{max} = -1,162 \cdot [\log10\, D] + 4.8$	0.72	<0.001*
Complete dataset	$\log10\, a_{max} = -0.853 \cdot [\log10\, D] + 4.0$	0.79	<0.001*

For each species studied the linear as well as the log-linear relation between D and a_{max} are given. Accompanying coefficients of determination (r^2) and probability (P) are also given.

*Statistical significance for the regression. Although a negative power law relation between stomatal density and size is generally known, comparison between the linear and logarithmic relations shows that our species data series do not have this power relation. From these results weak and unidirectional relations are apparent, and only negative relations are statistically significant (*M. cerifera*, *O. regalis*, *P. elliottii*, *Q. laurifolia*, and *T. distichum*). However, the pooled angiosperm and conifer data series, as well as the complete dataset, are best described by a log-transformed linear regression.

Table S4. Linear regressions of stomatal density D (number of stomata $\cdot \text{mm}^{-2}$) vs. CO_2 (ppm)

Species	Function	CV(RMSE) (%)	r^2	P
Acer rubrum	$D = -2.23 \cdot [\mathrm{CO_2}] + 1,398$	13	0.30	0.05*
Ilex cassine	$D = -0.77 \cdot [\mathrm{CO_2}] + 509$	11	0.39	0.001*
Myrica cerifera	$D = -2.39 \cdot [\mathrm{CO_2}] + 1,446$	12	0.40	0.002*
Osmunda regalis	$D = -0.33 \cdot [\mathrm{CO_2}] + 194$	22	0.09	0.15
Pinus elliottii	$D = -0.19 \cdot [\mathrm{CO_2}] + 134$	7	0.55	0.002*
Pinus taeda	$D = -1.14 \cdot [\mathrm{CO_2}] + 591$	6	0.56	0.005*
Quercus laurifolia	$D = -1.21 \cdot [\mathrm{CO_2}] + 1,650$	12	0.13	0.09
Quercus nigra	$D = -2.08 \cdot [\mathrm{CO_2}] + 1,316$	8	0.44	0.002*
Taxodium distichum	$D = -1.08 \cdot [\mathrm{CO_2}] + 613$	12	0.52	0.01*

For easier interspecies comparison, the range of variability is normalized and presented as the variability coefficient of the root mean squared errors CV(RMSE), in %.

*All statistically significant regressions ($P < 0.05$) also have significantly different slopes.

Table S5. Linear regressions of pore size a_{max} (μm^2) vs. CO_2 (ppm)

Species	Function	CV(RMSE) (%)	r^2	P
Acer rubrum	$a_{max} = -0.156 \cdot [\mathrm{CO_2}] + 101$	5	0.40	0.02*
Ilex cassine	$a_{max} = -0.108 \cdot [\mathrm{CO_2}] + 116$	9	0.04	0.35
Myrica cerifera	$a_{max} = 0.005 \cdot [\mathrm{CO_2}] + 29$	3	<0.001	0.94
Osmunda regalis	$a_{max} = -0.8 \cdot [\mathrm{CO_2}] + 497$	7	0.31	0.004*
Pinus elliottii	$a_{max} = 0.607 \cdot [\mathrm{CO_2}] + 310$	4	0.15	0.17
Pinus taeda	$a_{max} = -1.016 \cdot [\mathrm{CO_2}] + 579$	5	0.25	0.10
Quercus laurifolia	$a_{max} = -0.032 \cdot [\mathrm{CO_2}] + 32$	9	0.07	0.21
Quercus nigra	$a_{max} = -0.209 \cdot [\mathrm{CO_2}] + 156$	7	0.18	0.08
Taxodium distichum	$a_{max} = 0.051 \cdot [\mathrm{CO_2}] + 71$	3	0.06	0.46

For easier interspecies comparison, the range of variability is normalized and presented as the variability coefficient of the root mean squared errors CV(RMSE), in %.

*All statistically significant regressions ($P < 0.05$) also have significantly different slopes.

Table S6. Relative sensitivities in g_{smax}, D, and a_{max} of angiosperms and conifers to CO_2 (ppm) increase

Species	Slope(% $\cdot$ppm^{-1})	SE(% $\cdot$ppm^{-1})	r^2	P
Angiosperm				
g_{smax}	−0.33	0.04	0.35	<0.01*
D	−0.28	0.03	0.41	<0.01*†
a_{max}	−0.15	0.06	0.06	0.02*
Conifers				
g_{smax}	−0.37	0.09	0.33	<0.01*
D	−0.35	0.06	0.49	<0.01*†
a_{max}	−0.07	0.11	0.01	0.53

Intercept = 100% at CO_2 280 ppm, with slope, SE, r^2, and P of linear regressions.

*Statistically significant for the regression to CO_2, and slope significantly different from 0 ($P < 0.05$).

†Change in D between angiosperms and conifers is significantly different.

Table S7. Pore length/guard cell width linear relations

Species	Mean C_w (μm)	SD (μm)	n	Linear regression	r^2
Acer rubrum	6.79	0.94	36	$C_w = 0.36 \cdot [L] + 2.90$	0.49
Ilex cassine	10.26	1.33	27	$C_w = 0.28 \cdot [L] + 6.19$	0.57
Myrica cerifera	7.84	1.10	25	$C_w = 0.41 \cdot [L] + 3.57$	0.62
Osmunda regalis	16.5	1.92	21	$C_w = 0.37 \cdot [L] + 9.10$	0.65
Pinus elliottii	16.24	2.22	28	$C_w = 0.27 \cdot [L] + 6.66$	0.62
Pinus taeda	11.51	1.22	33	$C_w = 11.5$ μm	
Quercus laurifolia	6.72	0.77	22	$C_w = 0.27 \cdot [L] + 4.57$	0.49
Quercus nigra	7.29	1.21	27	$C_w = 0.26 \cdot [L] + 3.55$	0.56
Taxodium distichum	9.79	1.57	20	$C_w = 0.55 \cdot [L] + 1.52$	0.72

Species-specific relations between pore length (L) and guard cell width (Cw) are used to derive pore depth (l), based on the assumption that l is equal to Cw (1). Species-specific regressions between Cw and L are highly significant ($P < 0.001$), with exception of *P. taeda*. We therefore derive l from these species-specific regressions, except for *P. taeda*, for which a constant value is applied. The species-specific regressions are used to calculate gs_{max} for each species.

1. Franks PJ, Beerling DJ (2009) Maximum leaf conductance driven by CO2 effects on stomatal size and density over geologic time. *Proc Natl Acad Sci USA* 106:10343–10347.