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Appendix S1: Extended materials and methods information

Search strings used for systematic search on 3rd July 2017 were as follows:

CO2 OR carbon dioxide) AND (spring OR natural OR enrichment/enriched OR mofette OR outgassing OR vent) AND (plant/s)

Systematic searches of the literature returned 3,294 studies which were screened for relevance by title, and relevant titles were then assessed by abstract for their potential to meet the following stringent inclusion criteria:

1) Publications must study naturally growing plant species at both a (terrestrial) spring site and a local control site with similar environmental conditions

2) There must be a minimum difference of 100 ppm in average daily CO2 concentration between designated spring and control sites

3) Control sites must have an average daily CO2 concentration below 435 ppm and spring sites must have an average daily CO2 concentration above 465 ppm

4) Traits measured must be quantitative for inclusion in the meta-analysis (for example studies only reporting presence/absence of species were not included)

5) At least three individuals must be sampled from each site per species, and at least two measurements must be made per plant (where the type of measurement taken allowed for this).

6) As required for effect size calculation, traits are only included if mean trait value, a measure of variance (standard error or standard deviation) and sample size are given in the study

7) Measurements of plants taken from springs with contamination by [H_2S] > 0.02 ppm or [SO_2] > 0.015ppm are not included in this analysis

Appendix S2: Supplementary references

Data provided to meta-analyses

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Supplementary Table S1: Table of spring sites used to study plant responses to elevated CO_2

Country	Site	Data in meta-analysis?	Latitude	Longitude	Gas composition of at the spring study site			Soil pH		Koepper climate classification
					[CO_2]	[H_2S]	[SO_2]	Spring site	Control site	
Sites used in this meta-analysis										
Iceland	Ólafsvík	Y	64.9	-23.7	519-1179 ppmv	< 0.5 ppmv No smell (< 0.025 ppmv)	-	-	-	Polar tundra (ET)
Italy	Armaiolo	Y	43.3	11.6	~500-2300 ppmmol	-	-	-	-	Temperate with dry hot summer (Csa)
Italy	Bossoleto	Y	43.3	11.6	400-1200 ppmmol	0.022 ppmv	0.012 ppmv	5.6-6.8	7.5-7.7	Temperate with dry hot summer (Csa)
Italy	I Borboi	Y	43.4	10.7	500-1500 ppmmol	0.060 ppmmol	0.004 ppmmol		6-7	Temperate with dry hot summer (Csa)
Italy	Laiatico	Y	43.4	10.8	400-1500 ppmmol	0.022 ppmv	0.004 ppmv	6-7	6-7	Temperate with dry hot summer (Csa)
Slovenia	Strmec	Y	46.7	16	500-1000 ppmmol	-	-	5.0-5.2	5.0-5.2	Temperate without dry season, warm summer (Cfb)
Japan	Nibu	Y	38.5	140.0	~450-850 ppmmol	< 0.1 ppmv No smell (< 0.025 ppmv)	-	3.6-4.2	4.1-4.3	Temperate without dry season, hot summer (Cfa)
Japan	Ryuzin-numa	Y	40.7	141.0	~550-890 ppmmol	< 0.1 ppmv No smell (< 0.025 ppmv)	-	3.5-3.7	2.8-3.4	Temperate without dry season, hot summer (Cfa)
Japan	Yuno kawa	Y	40.7	141.0	~460-630 ppmmol	< 0.1 ppmv No smell (< 0.025 ppmv)	-	3.7-4.5	3.7-4.5	Temperate without dry season, hot summer (Cfa)
South Africa	Pleasant View	Y	-30.7	30.02	~480-600 ppmmol	-	-	4.2-4.4	4.3-4.5	Temperate without dry season, warm summer (Cfb)
Venezuela	Sta. Ana	Y	10.6	-63.13	(S1) ~34200-35800 ppmmol at the vent (S2) ~26800-27200 ppmmol at the vent	< 0.1 ppmmol	-	-	-	Tropical savannah (Aw)

					CO_2 concentrations approx. 1000					
Other sites used to study plant response to elevated CO_2										
Czech Republic	Plesná stream	N	50.1	12.46	>600 ppm at 50 cm vertical	-	-	-	-	Temperate without dry season, warm summer (Cfb)
Germany	Laacher See	N	50.4	7.25	Gradient 100-0% explored	-	-	4.0-6.0	5.5-6.3	Temperate oceanic climate (Cfb)
Italy	Orciatico	N	43.4	10.67	Avg. 465 ppmmol	-	-	-	-	Temperate with dry hot summer (Csa)
	Solfatara	N	42.5	12.13	450-850 ppmmol	0.245 ppmv	0.018ppmv	3.3-2.1	4.5-4.1	Temperate with dry hot summer (Csa)
Japan	Tashiro	N	40.7	140.92	400-1000 ppmmol	< 0.03 ppmmol	<0.03ppmmol	-	-	Temperate without dry season, hot summer (Cfa)
	Asahi	N	38.2	140	2123-2509 ppm	-	-	-	-	Temperate without dry season, hot summer (Cfa)
	Kosaka	N	40.4	140.8	503-7019 ppm	-	-	-	-	Temperate without dry season, hot summer (Cfa)
New Zealand	Hakanoa springs	N	-35.7	174.27	480-725 ppmv	< 0.18 ppmv	-	5.2-5.7	5.2-5.7	Temperate without dry season, warm summer (Cfb)
USA	Burning hills	N	37.3	-111.37	400-1000 ppm	-	-	-	-	Cold-desert climate (Bwk)
	Ichetucknee river springs	N	30.0	-82.76	450-500 ppmmol	-	-	-	-	Temperate without dry season, hot summer (Cfa)
	Ochre Springs	N	44.6	-110.4	419-482 ppmv	-	-	-	-	Dry summer subarctic (Dsc)
	Mammoth Upper Terrace	N	45.0	-110.7	401-607 ppmv	-	-	-	-	Warm-summer continental (Dfb)
Slovenia	Rihtarovci	N	46.6	16.1	Gradient 400 to >2500 ppmmol	-	-	-	-	Temperate without dry season, warm summer (Cfb)

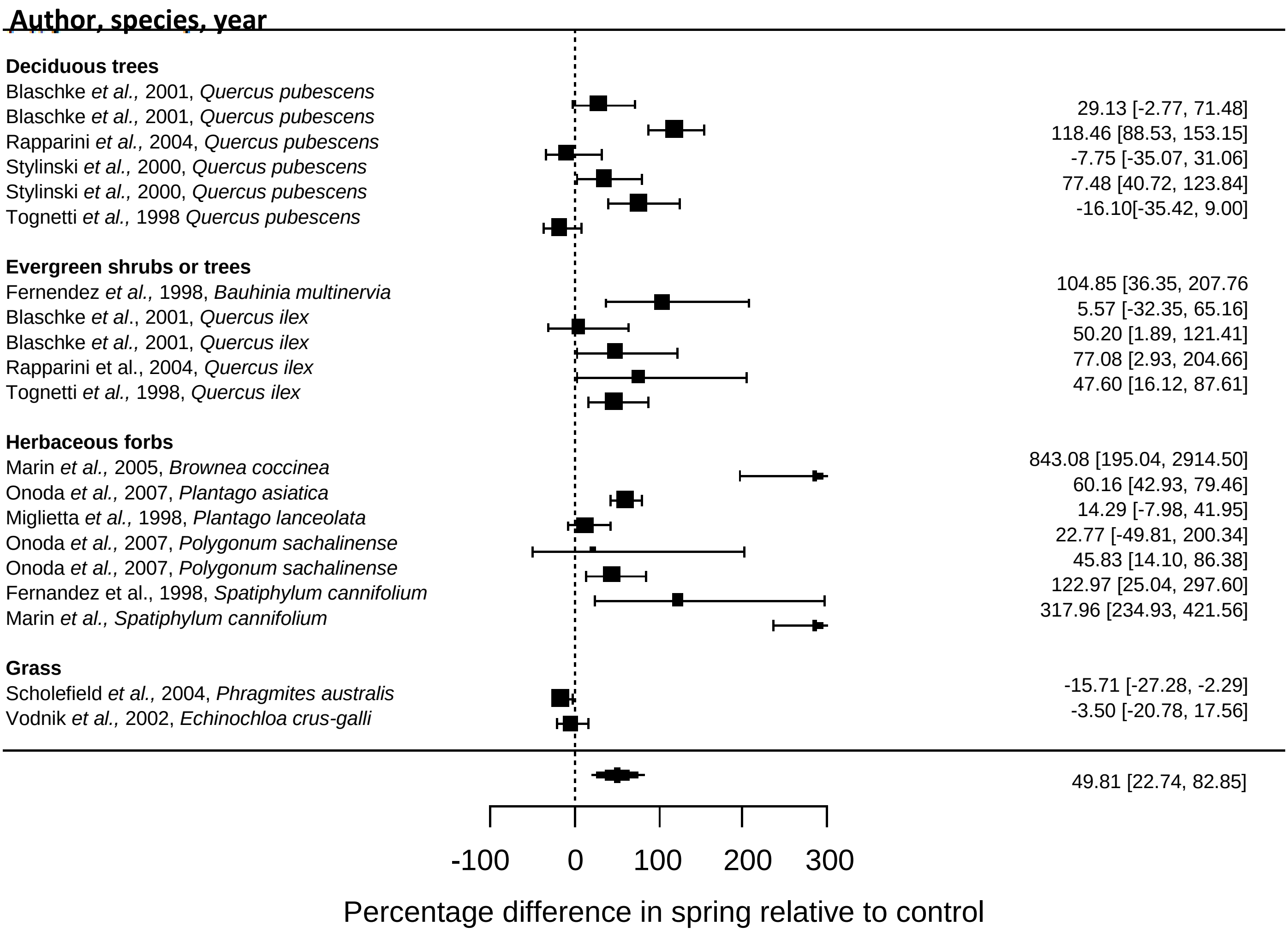
Supplementary Table S2: Tests for heterogeneity in data collected for each trait measured across natural CO_2 spring sites

Statistic	Q stat	Df	p-val	I^2
Description	Is the variability in the observed effect size larger than would be expected based on sampling variability alone?			Percentage of total variation across studies that is due to heterogeneity rather than chance
Stomatal conductance	360.6	31	<0.0001	92.28%
Abaxial stomatal index	214.3	22	<0.0001	88.75%
Adaxial stomatal index	109.5	7	<0.0001	99.13%
Abaxial stomatal density	279.8	24	<0.0001	93.93%
Adaxial stomatal density	100.8	8	<0.0001	98.38%
Photosynthetic rate	180.7	8	<0.0001	96.47%
V_{cmax}	13.9	6	0.0312	56.42%
J_{max}	21.1	6	0.017	71.17%
Leaf chlorophyll content	34.8	7	<0.0001	80.88%
Leaf carbon content	63.3	14	<0.0001	78.69%
Leaf sugar content	172.5	4	<0.0001	95.94%
Leaf starch content	236.3	12	<0.0001	96.04%
Leaf total non-structural carbohydrate content	311.8	10	<0.0001	97.00%
Leaf nitrogen content	232.5	22	<0.0001	89.79%
Leaf carbon:nitrogen ratio	8.1	4	0.0893	49.87%
Specific leaf area	33.5	4	<0.0001	84.58%

Supplementary Table S3: Publication bias statistics for traits where publication bias was detected in CO_2 spring meta-analysis

Trait	Egger's test for funnel plot asymmetry		Rosenthal's Fail-safe number	
	T test	P value	Fail-safe number	5N +10
Abaxial stomatal index	2.7938	0.0109	92	125
Adaxial stomatal density	-3.1970	0.0151	95	55
Leaf chlorophyll content	2.5425	0.0439	0?	50
Leaf carbon content	-2.3206	0.0372	27	85

Supplementary Figure S1: Photosynthetic rate percentage difference between plants at elevated and ambient [CO_2] at naturally occurring CO_2 springs from individual studies included in this meta-analysis. Author(s) and species appear on the left hand side, numbers on the right hand side are effect size, with 95% confidence intervals in parentheses. Squares indicating mean effect size are drawn proportionally to the precision of the estimate. The summary polygon at the bottom of the plot indicates the mean effects size when all 20 estimates are analysed together using a random effects model. Note that in subgroup analysis plants were categorised as trees, which included both 'deciduous trees' and 'evergreen shrubs or trees', or herbs, which included 'herbaceous forbs' and grasses, rather than the functional groups used for visualisation here.



Supplementary Figure S2: Stomatal conductance (g_s) percentage difference between plants at elevated and ambient [CO_2] at naturally occurring CO_2 springs from individual studies included in this meta-analysis. Author(s) and species appear on the left hand side, numbers on the right hand side are effect size, with 95% confidence intervals in parentheses. Squares indicating mean effect size are drawn proportionally to the precision of the estimate. The summary polygon at the bottom of the plot indicates the mean effects size when all 32 estimates are analysed together using a random effects model. Note that in subgroup analysis plants were categorised as trees, which included both ‘deciduous trees’ and ‘evergreen shrubs or trees’ or herbs, which included ‘herbaceous forbs’ and grasses, or just herbaceous forbs, rather than the functional groups used for visualisation here.