

Vapour pressure deficit is the main driver of tree canopy conductance across biomes

Víctor Flo¹, Jordi Martínez-Vilalta^{1,2}, Víctor Granda¹, Maurizio Mencuccini^{1,3}, Rafael Poyatos^{1,2}

¹CREAF, E08193 Bellaterra (Cerdanyola del Vallès), Catalonia, Spain

²Univ Autònoma de Barcelona, Cerdanyola del Vallès 08193, Spain

³ICREA, Barcelona 08010, Spain

Contents of this file

Figures S1 to S8

Tables S1 to S4

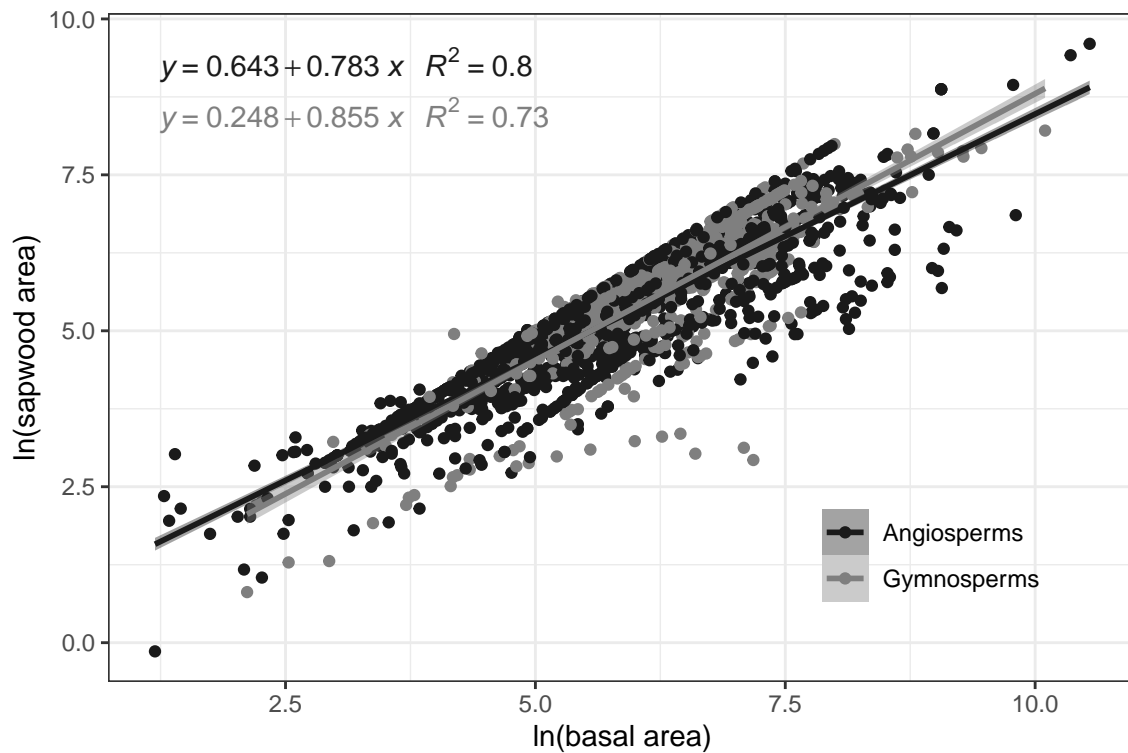


Figure S1: SAPFLUXNET global scaling relationship between basal area and sapwood area. Basal area and sapwood area are both in cm². Shaded areas are 95% model confidence interval.

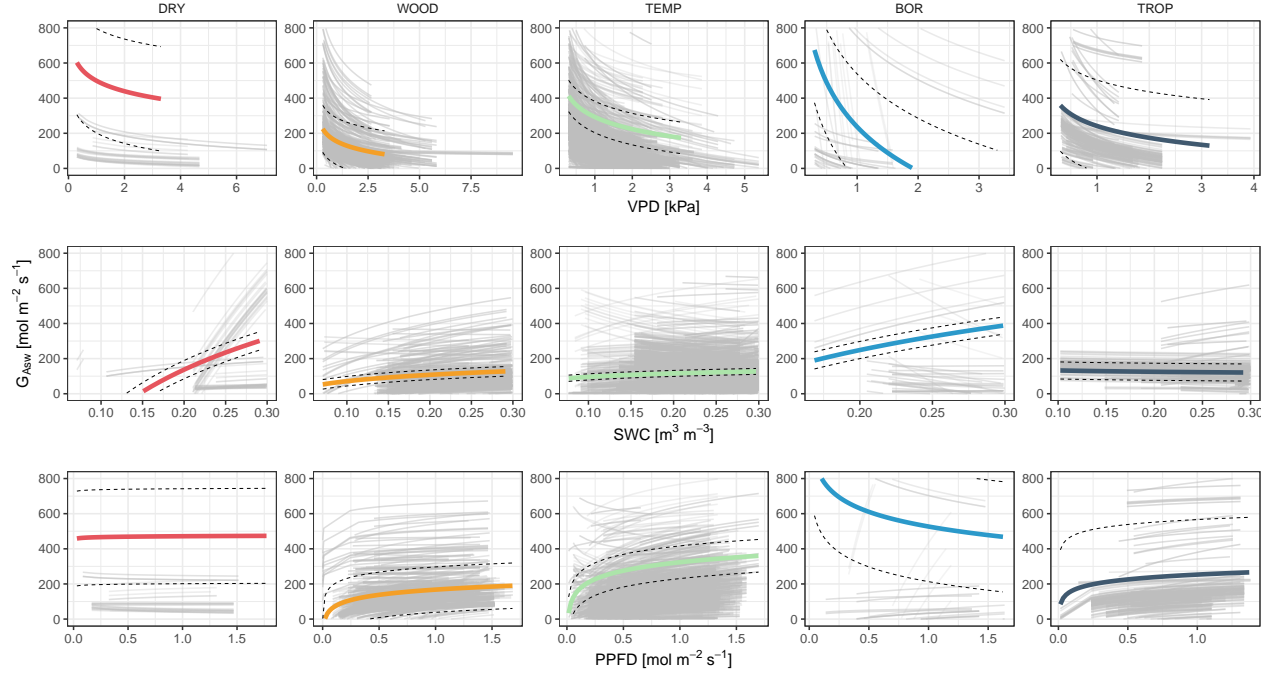


Figure S2: Log relationships of the three environmental variables estimated with the FULL model (VPD + SWC + PPFD) and grouped by biome. Coloured lines are biome-averaged models calculated from LMM predictions with G_{Asw} as response variable and the neperian logarithm of the environmental constrains as explanatory variables. Dashed line shows standard error of the average models calculated with bootstrap prediction using 100 simulations.

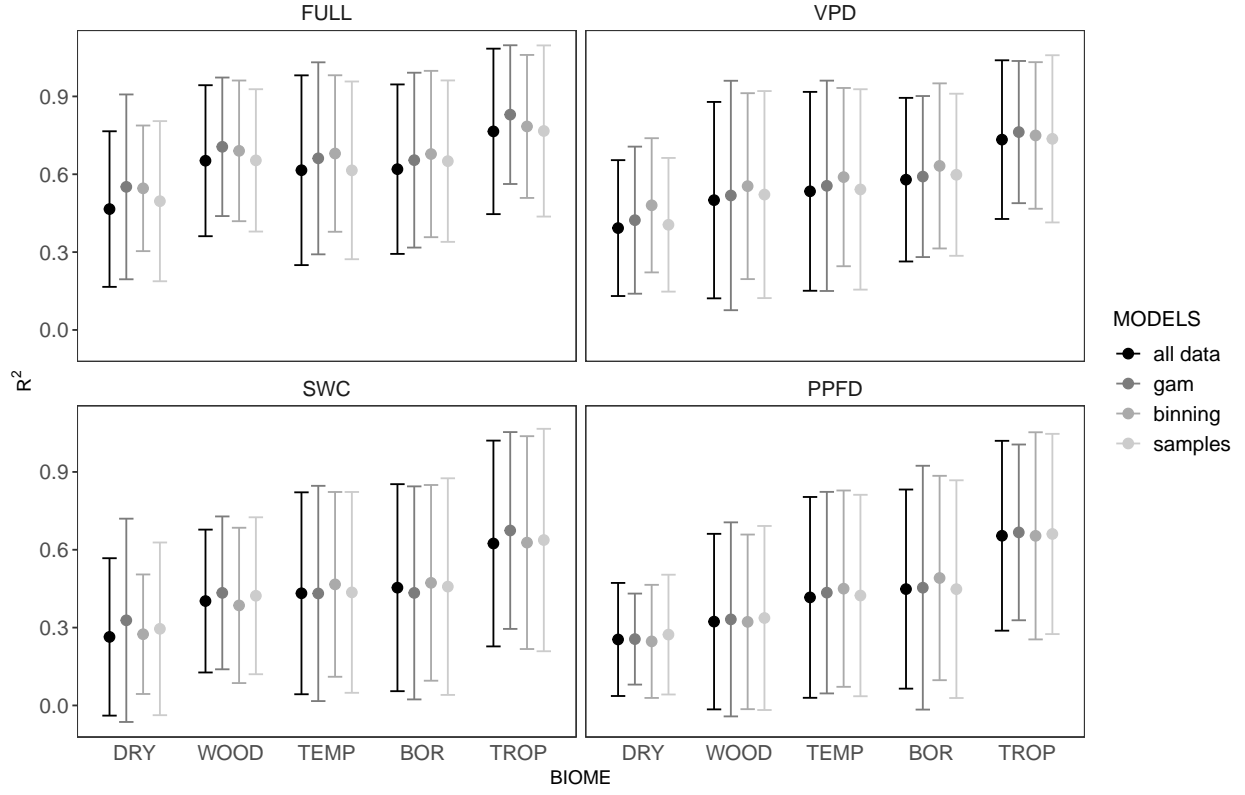


Figure S3: Comparison of biomes R^2_{FULL} (VPD + SWC + PPFD), R^2_{VPD} (VPD), R^2_{SWC} (SWC) and R^2_{PPFD} (PPFD) calculated with the four modelling approaches: using linear mixed models on all data, binned data and sampled data and, using GAM models on all data. Dots are mean values for each biome and error bars represent two standard deviations. There were no intra-biome significant differences among models.

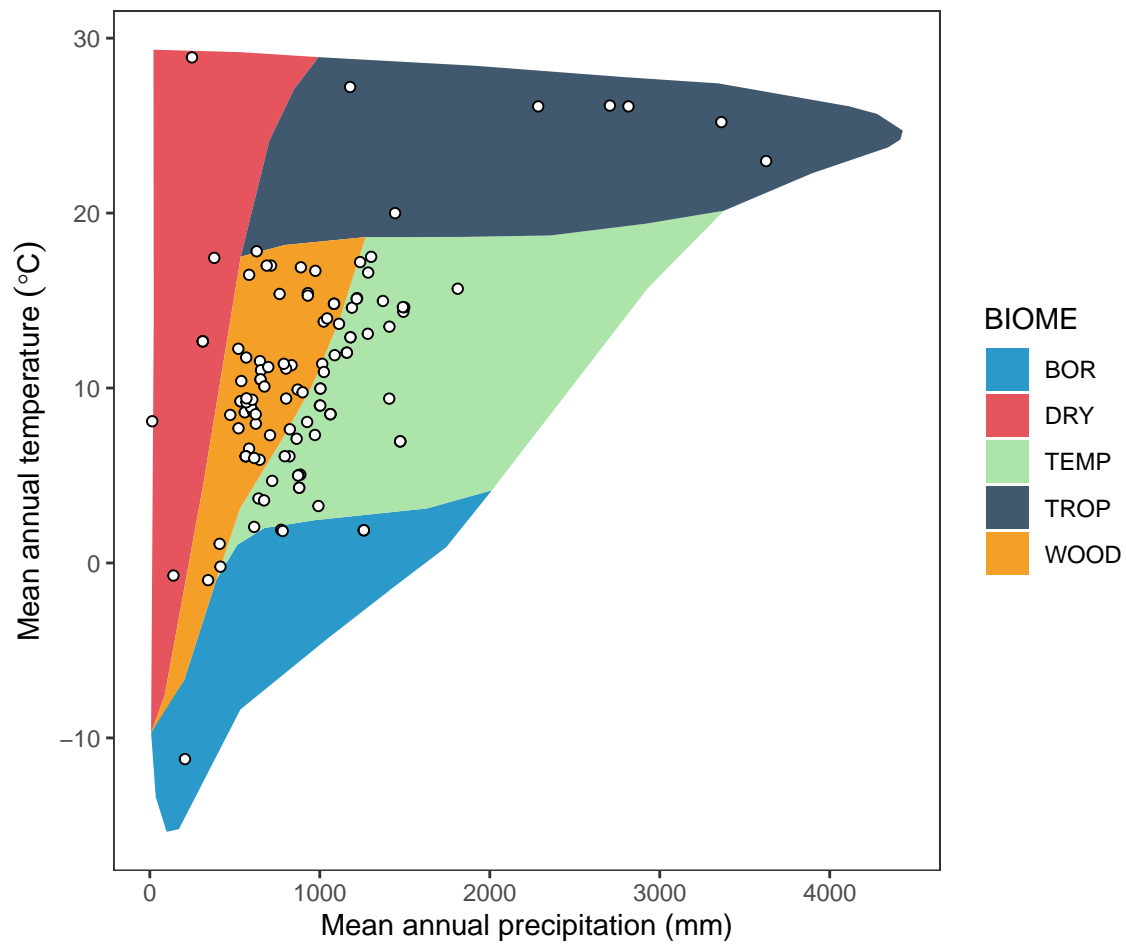


Figure S4: Bioclimatic distribution of the SAPFLUXNET datasets used in the study. Points show the different datasets in a Whittaker diagram showing the classification of the aggregated biomes used in the study.

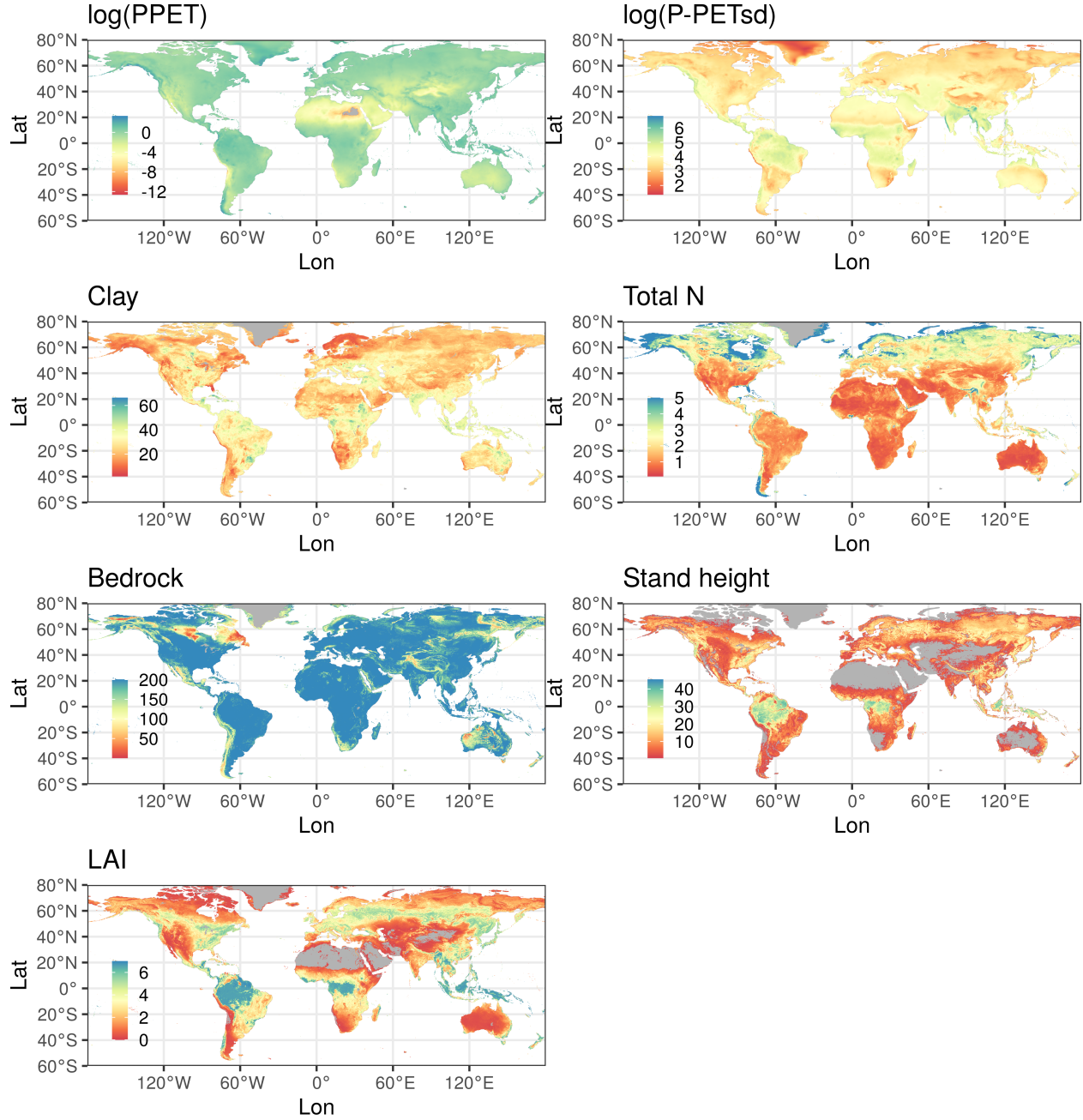


Figure S5: Global projection of climatic, soil and stand structure variables. $\log(\text{PPET})$: logarithm of precipitation over potential evapotranspiration [$\log(\text{mm mm}^{-1})$]; $\log(\text{P-PET}_{\text{sd}})$: logarithm of the standard deviation of the difference between precipitation and potential evapotranspiration [$\log(\text{mm})$]; Clay: percentage of clay in the soil; Total N: total nitrogen in the soil [g kg^{-1}]; Bedrock [cm]; Stand height [m]; LAI: leaf area index [$\text{m}^2 \text{m}^{-2}$]. Total N values above 5 g kg^{-1} were truncated.

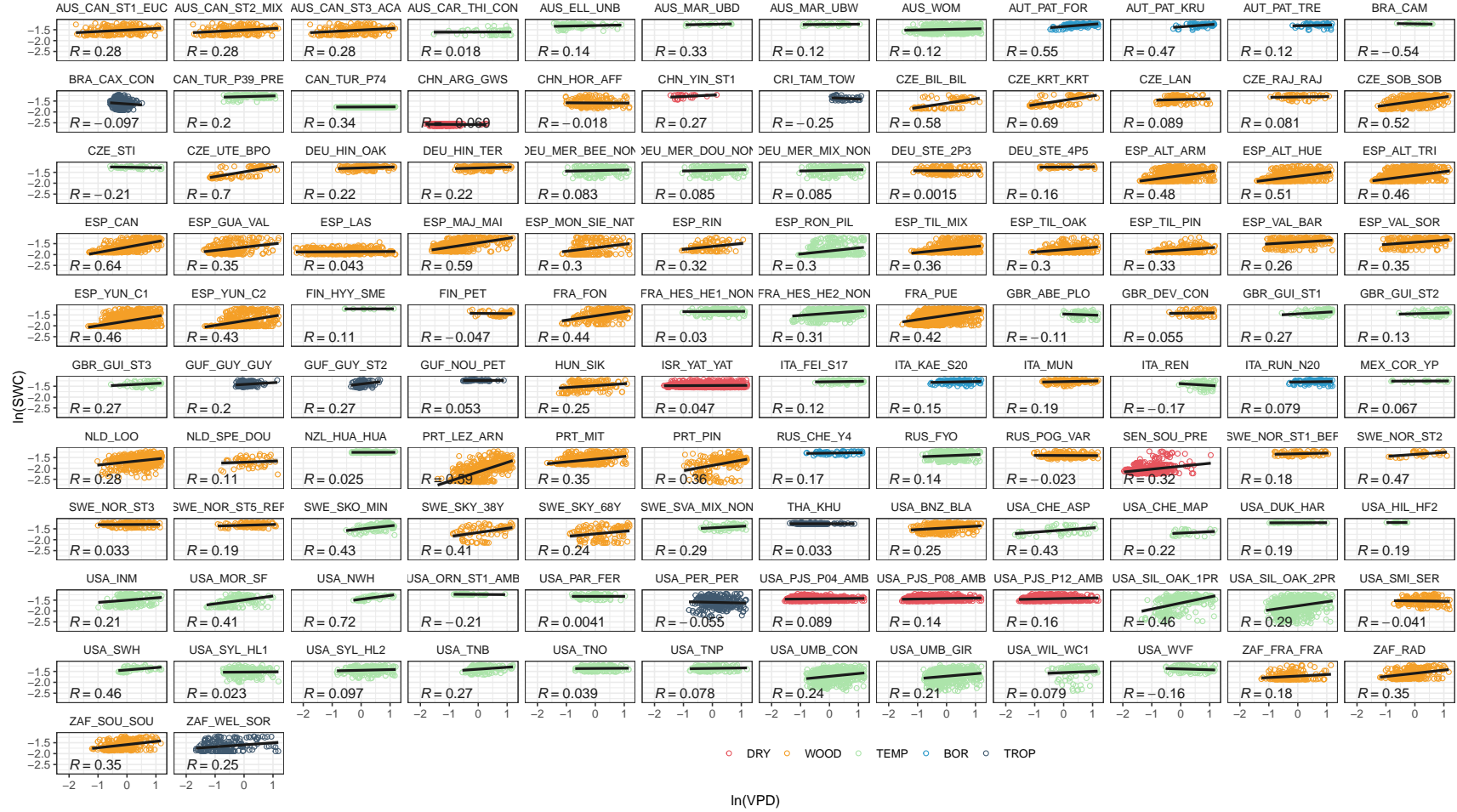


Figure S6: Correlations at the site level between VPD and SWC. R values are Pearson correlations. Different colors indicate the biome. DRY: dry and desert biomes; WOOD: woodlands and shrublands; TEMP: temperate biomes; BOR: boreal and tundra; TROP: tropical and subtropical biomes.

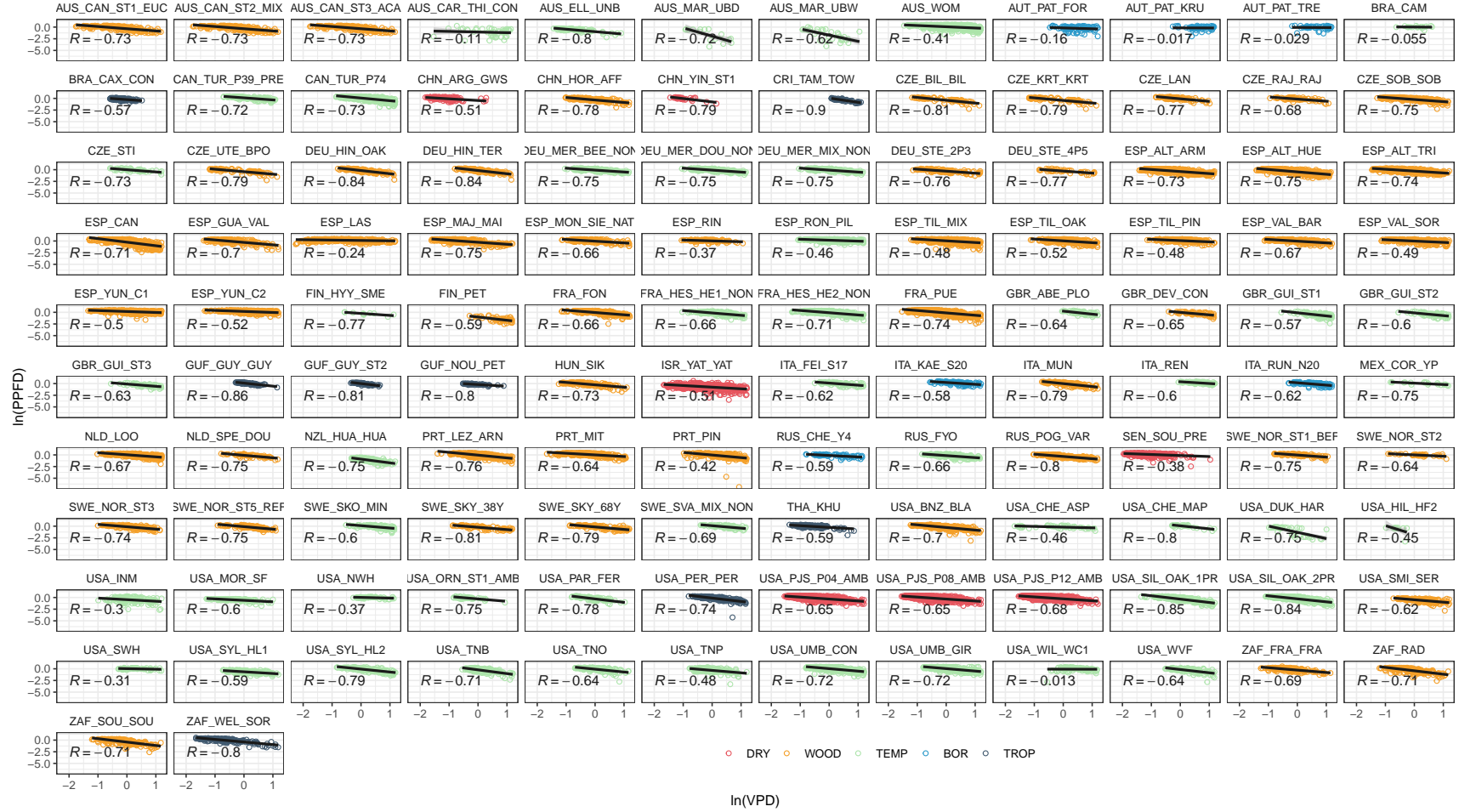


Figure S7: Correlations at the site level between VPD and PPFD. R values are Pearson correlations. Different colors indicate the biome. DRY: dry and desert biomes; WOOD: woodlands and shrublands; TEMP: temperate biomes; BOR: boreal and tundra; TROP: tropical and subtropical biomes.

∞

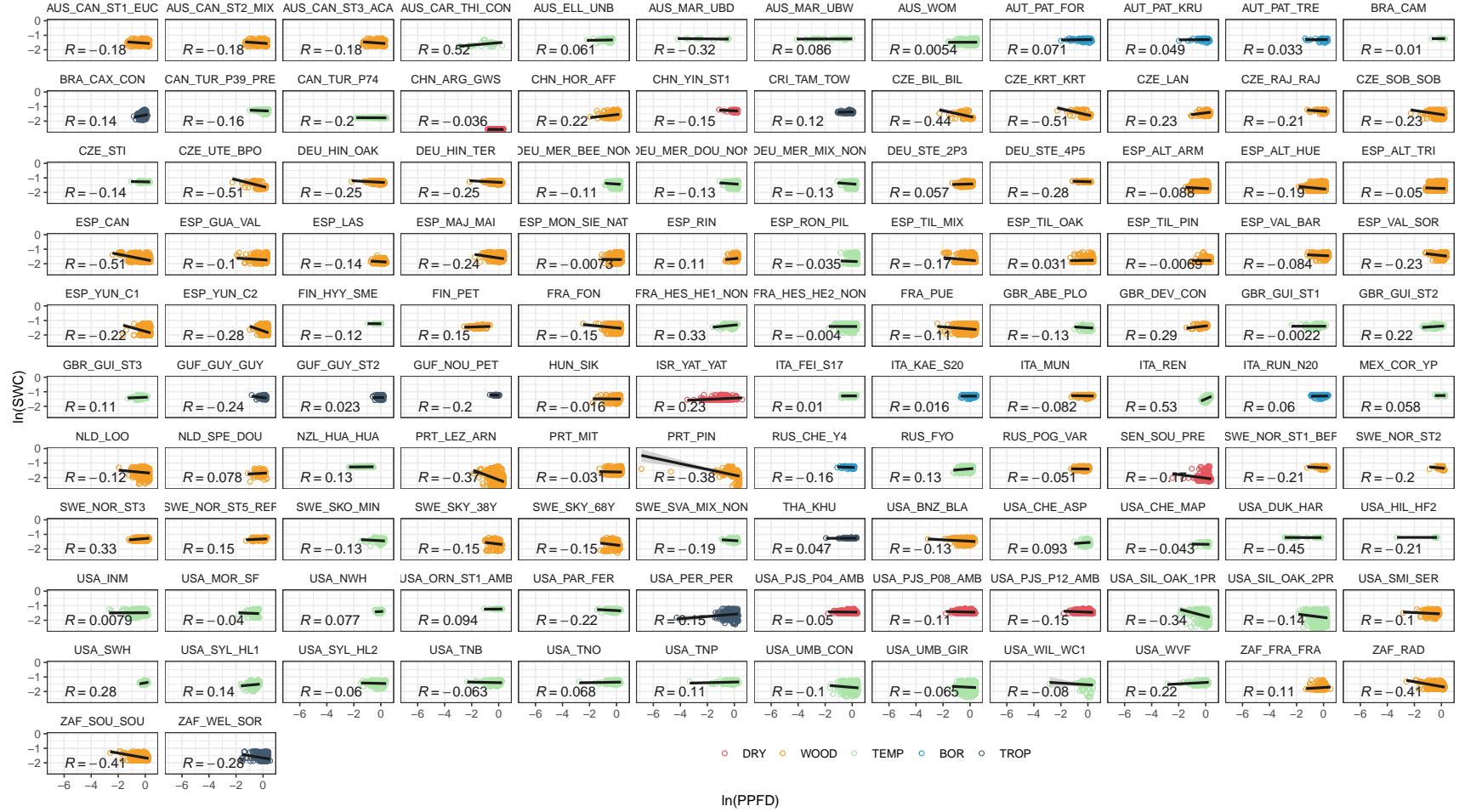


Figure S8: Correlations at the site level between PPFD and SWC. R values are Pearson correlations. Different colors indicate the biome. DRY: dry and desert biomes; WOOD: woodlands and shrublands; TEMP: temperate biomes; BOR: boreal and tundra; TROP: tropical and subtropical biomes.

Table S1: SAPFLUXNET stand treatments included in the this study.

Plot treatment
NA
None
Control
control
Ambient Control
Control - Unthinned
natural conditions
Reference
1Premortality
2premortality
distructive sampling
Girdling early successional
Pre-thinning
Before thinning
Before Thinning
non thinned
none (periodict thinning every 5-6 years 20 to 25% of basal area)
Radiation Level
AMBIENT CO2 FACE rings
fertilization at plantation
AcaciaMonoculture
MixtureEucalyptusAndAcacia
EucalyptusMonoculture
Pre Irrigation

Table S2: SAPFLUXNET sites included in the study. Biome was estimated using a Whittaker diagram. *Indicates that the biome was manually adjusted and confirmed by SAPFLUXNET contributors.

Site code	Latitude	Longitude	Biome	# Tree-days	# Species	# Trees
AUS_CAN_ST1_EUC	-37.58	149.17	WOOD	500	1	12
AUS_CAN_ST2_MIX	-37.58	149.17	WOOD	1077	2	22
AUS_CAN_ST3_ACA	-37.58	149.17	WOOD	609	1	12
AUS_CAR_THI_CON	-38.38	146.68	TEMP	69	1	3
AUS_ELL_UNB	-36.78	146.58	TEMP	140	1	2
AUS_MAR_UBD	-37.69	145.56	TEMP	32	2	2
AUS_MAR_UBW	-37.89	145.57	TEMP	121	3	5
AUS_WOM	-37.42	144.09	TEMP	4454	2	11
AUT_PAT_FOR	47.21	11.45	BOR	286	1	3
AUT_PAT_KRU	47.21	11.45	BOR	105	1	2
AUT_PAT_TRE	47.21	11.45	BOR	133	1	3
BRA_CAM	-22.69	-45.52	TROP*	89	1	5
BRA_CAX_CON	-1.79	-51.43	TROP	2406	8	15
CAN_TUR_P39_PRE	42.71	-80.36	TEMP	2225	1	18
CAN_TUR_P74	42.71	-80.35	TEMP	10586	1	16
CHN_ARG_GWS	41.38	89.94	DRY	300	1	2
CHN_HOR_AFF	42.72	122.37	WOOD	2786	1	16
CHN_YIN_ST1	42.45	85.72	DRY	122	1	5
CRI_TAM_TOW	10.39	-84.63	TROP	1266	17	26
CZE_BIL_BIL	49.25	16.69	TEMP*	400	1	6
CZE_KRT_KRT	49.32	16.75	TEMP*	435	1	6
CZE_LAN	48.68	16.95	TEMP*	1775	3	17
CZE_RAJ_RAJ	49.44	16.70	TEMP*	360	1	6
CZE_SOB_SOB	49.25	16.69	TEMP*	1727	1	6
CZE_STI	49.04	17.97	TEMP	348	1	8
CZE_UTE_BPO	49.28	16.65	TEMP*	456	1	6
DEU_HIN_OAK	53.33	13.19	TEMP*	864	1	8
DEU_HIN_TER	53.33	13.19	TEMP*	1954	2	16
DEU_MER_BEE_NON	49.27	7.81	TEMP	841	1	8
DEU_MER_DOU_NON	49.27	7.81	TEMP	895	1	7
DEU_MER_MIX_NON	49.27	7.81	TEMP	1945	2	17
DEU_STE_2P3	53.10	13.00	TEMP*	1228	1	10
DEU_STE_4P5	53.10	13.00	TEMP*	402	1	10
ESP_ALT_ARM	40.78	-2.33	WOOD	8306	3	15
ESP_ALT_HUE	40.79	-2.29	WOOD	3698	2	8
ESP_ALT_TRI	40.80	-2.23	WOOD	5411	2	12
ESP_CAN	41.43	2.07	WOOD	6871	4	21
ESP_GUA_VAL	40.90	-4.03	WOOD	3424	1	24
ESP_LAS	28.31	-16.57	WOOD	4406	1	10
ESP_MAJ_MAI	39.94	-5.77	WOOD	2833	1	6
ESP_MON_SIE_NAT	41.12	-3.50	WOOD	2587	3	20
ESP_RIN	40.60	-6.02	WOOD	770	1	8
ESP_RON_PIL	36.69	-5.02	TEMP	4114	2	12
ESP_TIL_MIX	41.33	1.01	WOOD	15699	2	32
ESP_TIL_OAK	41.33	1.01	WOOD	2381	1	10
ESP_TIL_PIN	41.33	1.01	WOOD	1976	1	9
ESP_VAL_BAR	42.20	1.82	WOOD	1394	1	12
ESP_VAL_SOR	42.20	1.81	WOOD	1943	1	13
ESP_YUN_C1	36.72	-4.97	WOOD	2935	1	6
ESP_YUN_C2	36.72	-4.97	WOOD	830	1	6
FIN_HYY_SME	61.85	24.29	TEMP	10	1	1
FIN_PET	69.49	27.23	BOR*	216	1	7
FRA_FON	48.48	2.78	TEMP*	720	1	3
FRA_HES_HE1_NON	48.67	7.06	TEMP	1273	1	10
FRA_HES_HE2_NON	48.67	7.06	TEMP	4167	1	10
FRA_PUE	43.74	3.60	WOOD	23566	1	25
GBR_ABE_PLO	56.62	-3.80	TEMP	692	1	15
GBR_DEV_CON	56.03	-3.72	TEMP*	215	1	4
GBR_GUI_ST1	57.27	-4.82	TEMP	834	1	15

Table S2: SAPFLUXNET sites included in the study. Biome was estimated using a Whittaker diagram. *Indicates that the biome was manually adjusted and confirmed by SAPFLUXNET contributors. (continued)

Site code	Latitude	Longitude	Biome	# Tree-days	# Species	# Trees
GBR_GUI_ST2	57.27	-4.82	TEMP	621	1	9
GBR_GUI_ST3	57.27	-4.82	TEMP	444	1	8
GUF_GUY_GUY	5.28	-52.92	TROP	710	6	6
GUF_GUY_ST2	5.28	-52.91	TROP	885	7	11
GUF_NOU_PET	4.08	-52.68	TROP	923	10	22
HUN_SIK	47.93	20.44	WOOD	550	2	4
ISR_YAT_YAT	31.34	35.05	DRY	15766	1	24
ITA_FEI_S17	46.69	10.61	TEMP	378	1	6
ITA_KAE_S20	46.70	10.61	BOR	586	1	6
ITA_MUN	46.68	10.58	TEMP*	885	1	6
ITA_REN	46.59	11.43	TEMP	577	3	8
ITA_RUN_N20	46.70	10.64	BOR	766	2	8
MEX_COR_YP	19.49	-97.04	TEMP	113	1	7
NLD_LOO	52.17	5.74	TEMP*	3033	1	6
NLD_SPE_DOU	52.25	5.69	TEMP*	150	1	3
NZL_HUA_HUA	-36.80	174.49	TEMP	1107	1	6
PRT_LEZ_ARN	38.83	-8.82	WOOD	1764	1	4
PRT_MIT	38.54	-8.00	WOOD	1510	1	4
PRT_PIN	38.25	-8.76	WOOD	2991	2	20
RUS_CHE_Y4	68.74	161.41	BOR	587	1	11
RUS_FYO	56.46	32.92	TEMP	2338	3	17
RUS_POG_VAR	56.36	92.95	TEMP*	1290	3	9
SEN_SOU_PRE	16.34	-15.43	DRY	1706	1	3
SWE_NOR_ST1_BEF	60.09	17.48	TEMP*	843	2	22
SWE_NOR_ST2	60.09	17.48	TEMP*	194	2	6
SWE_NOR_ST3	60.09	17.48	TEMP*	1195	2	37
SWE_NOR_ST5_REF	60.08	17.48	TEMP*	1255	3	25
SWE_SKO_MIN	58.36	12.15	TEMP	1072	1	11
SWE_SKY_38Y	60.13	17.84	TEMP*	455	1	12
SWE_SKY_68Y	60.10	17.83	TEMP*	1046	2	12
SWE_SVA_MIX_NON	64.26	19.77	TEMP	1549	2	20
THA_KHU	15.27	103.08	TROP	1278	1	6
USA_BNZ_BLA	64.70	-148.32	BOR*	1705	1	6
USA_CHE_ASP	45.94	-90.27	TEMP	3995	6	142
USA_CHE_MAP	45.95	-90.26	TEMP	3378	2	145
USA_DUK_HAR	36.98	-79.09	TEMP	621	6	33
USA_HIL_HF2	36.22	-78.86	TEMP	263	5	22
USA_INM	39.32	-86.41	TEMP	1648	6	9
USA_MOR_SF	39.32	-86.41	TEMP	680	4	6
USA_NWH	34.58	-91.26	TEMP	525	2	10
USA_ORN_ST1_AMB	35.90	-84.33	TEMP	310	1	8
USA_PAR_FER	35.80	-76.67	TEMP	736	1	8
USA_PER_PER	30.21	-83.87	TROP	18180	1	80
USA_PJS_P04_AMB	34.39	-106.53	DRY	12129	2	10
USA_PJS_P08_AMB	34.39	-106.53	DRY	10754	2	10
USA_PJS_P12_AMB	34.39	-106.53	DRY	12528	2	10
USA_SIL_OAK_1PR	39.92	-74.60	TEMP	2304	4	18
USA_SIL_OAK_2PR	39.92	-74.60	TEMP	6790	4	22
USA_SMI_SER	38.89	-76.56	TEMP*	1733	5	30
USA_SWH	34.11	-91.13	TEMP	956	2	16
USA_SYL_HL1	46.24	-89.35	TEMP	8620	3	48
USA_SYL_HL2	46.24	-89.35	TEMP	3678	4	20
USA_TNB	36.47	-84.70	TEMP	1240	4	8
USA_TNO	35.97	-84.28	TEMP	1271	5	9
USA_TNP	35.96	-84.29	TEMP	1342	5	9
USA_UMB_CON	45.56	-84.71	TEMP	17923	5	57
USA_UMB_GIR	45.56	-84.70	TEMP	19175	4	57
USA_WIL_WC1	45.81	-90.09	TEMP	1306	5	16
USA_WVF	39.06	-79.69	TEMP	989	5	8

Table S2: SAPFLUXNET sites included in the study. Biome was estimated using a Whittaker diagram. *Indicates that the biome was manually adjusted and confirmed by SAPFLUXNET contributors. (*continued*)

Site code	Latitude	Longitude	Biome	# Tree-days	# Species	# Trees
ZAF_FRA_FRA	-33.88	19.06	WOOD	563	1	3
ZAF_RAD	-34.08	19.11	WOOD	660	1	3
ZAF_SOU_SOU	-34.09	19.09	WOOD	424	1	2
ZAF_WEL_SOR	-33.48	18.96	WOOD*	538	1	3

Table S3: Table of equivalence between Whittaker biomes and the groups of biomes used in the study.

Original biome name	Study biome group
Desert	DRY
Temperate grassland desert	DRY
Subtropical desert	DRY
Woodland/shrubland	WOOD
Temperate forest	TEMP
Boreal forest	BOR
Tundra	BOR
Tropical rainforest	TROP
Tropical seasonal forest/savanna	TROP

Table S4: Summary table of site level R_{VPD}^2 , R_{SWC}^2 , R_{PPFD}^2 , climate, soil properties and vegetation structure data. PPET is in [mm mm⁻¹], P-PET_{sd} is in [mm], Clay and Sand are in [%], Total N is in [g kg⁻¹], Stand height is in [m], LAI is in [m²_{leaves} m²_{soil}]. Letters show data source: a = SAPFLUXNET, b = Global rasters, c = SAPFLUXNET plant height.

Site code	R_{VPD}^2	R_{SWC}^2	R_{PPFD}^2	Relimp VPD	Relimp SWC	Relimp PPFD	PPET	P - PET _{sd}	Clay	Sand	Total N	Bedrock	Stand height	LAI
AUS_CAN_ST1_EUC	0.77	0.49	0.60	0.66	0.34	0.00	1.23	47.52	26.30 b	45.10 b	1.02	184	22.00 a	1.39 a
AUS_CAN_ST2_MIX	0.83	0.62	0.72	0.83	0.17	0.00	1.23	47.52	26.30 b	45.10 b	1.02	184	21.80 a	2.07 a
AUS_CAN_ST3_ACA	0.83	0.69	0.75	0.84	0.15	0.02	1.23	47.52	26.30 b	45.10 b	1.02	184	11.80 a	1.35 a
AUS_CAR_THI_CON	0.41	0.00	0.07	0.81	0.05	0.14	1.36	49.01	27.20 b	44.30 b	2.34	111	17.21 a	4.80 a
AUS_ELL_UNB	0.86	0.46	0.76	0.98	0.00	0.02	1.08	67.16	26.70 b	48.50 b	1.95	63	25.00 a	6.20 b
AUS_MAR_UBD	0.81	0.23	0.37	0.82	0.15	0.04	1.35	70.37	26.60 b	44.60 b	1.90	89	25.00 a	2.10 a
AUS_MAR_UBW	0.90	0.78	0.81	0.89	0.00	0.11	1.21	65.38	27.90 b	43.90 b	2.00	173	40.00 a	2.30 a
AUS_WOM	0.79	0.52	0.51	0.79	0.00	0.20	1.09	69.35	25.90 b	52.90 b	1.97	172	22.00 a	2.20 a
AUT_PAT_FOR	0.77	0.69	0.64	0.94	0.00	0.06	2.17	16.78	5.00 a	60.00 a	3.94	180	12.00 a	4.30 b
AUT_PAT_KRU	0.43	0.27	0.28	0.84	0.07	0.09	2.17	16.78	5.00 a	60.00 a	3.94	180	0.75 a	4.30 b
AUT_PAT_TRE	0.56	0.27	0.20	0.70	0.30	0.00	2.17	16.78	5.00 a	60.00 a	3.94	180	4.00 a	4.30 b
BRA_CAM	0.84	0.70	0.70	0.65	0.27	0.07	1.66	88.82	27.60 b	52.00 b	2.26	200	12.00 a	5.30 a
BRA_CAX_CON	0.75	0.68	0.68	0.73	0.00	0.27	1.90	122.90	8.00 a	79.00 a	1.45	197	38.00 b	5.30 a
CAN_TUR_P39_PRE	0.49	0.33	0.31	0.72	0.09	0.19	1.39	42.08	1.00 a	98.00 a	1.58	200	23.40 a	5.30 a
CAN_TUR_P74	0.21	0.32	0.16	0.31	0.33	0.35	1.39	41.87	1.00 a	98.00 a	1.60	200	16.20 a	6.70 a
CHN_ARG_GWS	0.45	0.34	0.35	0.52	0.45	0.03	0.01	63.51	17.70 b	46.00 b	0.70	172	7.90 a	0.36 a
CHN_HOR_AFF	0.37	0.33	0.32	0.51	0.47	0.01	0.59	31.24	8.00 a	83.00 a	1.00	200	9.05 a	1.61 a
CHN_YIN_ST1	0.46	0.46	0.44	0.48	0.41	0.11	0.19	35.09	20.80 b	32.90 b	2.41	148	10.60 a	0.50 b
CRI_TAM_TOW	0.68	0.68	0.67	0.47	0.15	0.37	3.57	159.99	36.10 b	34.70 b	2.75	200	30.60 a	3.30 a
CZE_BIL_BIL	0.53	0.53	0.41	0.52	0.20	0.29	0.71	28.98	29.60 b	27.40 b	1.91	200	14.00 a	6.00 b
CZE_KRT_KRT	0.61	0.50	0.30	0.62	0.04	0.34	0.85	27.00	26.00 b	27.40 b	2.10	200	17.00 a	5.70 b
CZE_LAN	0.74	0.73	0.69	0.67	0.07	0.26	0.66	37.49	17.80 a	71.80 a	2.46	200	36.00 a	6.04 a
CZE_RAJ_RAJ	0.35	0.36	0.39	0.37	0.03	0.60	0.99	26.14	21.80 b	33.90 b	1.96	200	18.00 a	4.60 b
CZE_SOB_SOB	0.40	0.43	0.13	0.49	0.30	0.21	0.71	28.98	29.60 b	27.40 b	1.91	200	21.00 a	6.00 b
CZE_STI	0.52	0.36	0.43	0.69	0.23	0.09	1.13	27.10	34.20 a	47.60 a	1.65	200	31.00 a	5.50 a
CZE_UTE_BPO	0.64	0.67	0.53	0.41	0.17	0.42	0.75	29.86	26.70 b	23.80 b	2.71	200	18.00 a	6.10 b
DEU_HIN_OAK	0.36	0.18	0.29	0.93	0.06	0.01	0.95	35.10	17.90 b	49.90 b	2.42	200	31.45 c	5.70 b
DEU_HIN_TER	0.22	0.17	0.18	0.74	0.02	0.24	0.95	35.10	18.00 b	50.50 b	2.05	200	24.42 c	5.60 b
DEU_MER_BEE_NON	0.38	0.25	0.27	0.80	0.05	0.15	1.48	47.33	4.00 a	71.00 a	2.56	200	23.00 a	5.90 a
DEU_MER_DOU_NON	0.38	0.25	0.18	0.58	0.29	0.14	1.48	47.33	4.00 a	71.00 a	2.56	200	29.00 a	5.30 a
DEU_MER_MIX_NON	0.35	0.21	0.25	0.85	0.01	0.14	1.48	47.33	4.00 a	71.00 a	2.56	200	30.00 a	6.10 a
DEU_STE_2P3	0.48	0.14	0.25	0.84	0.08	0.08	0.90	37.45	2.50 a	92.50 a	3.28	200	27.20 a	4.30 b
DEU_STE_4P5	0.45	0.28	0.33	0.64	0.32	0.04	0.90	37.45	2.50 a	92.50 a	3.28	200	27.20 a	4.30 b
ESP_ALT_ARM	0.44	0.39	0.29	0.77	0.19	0.04	0.66	65.80	21.90 b	41.50 b	1.27	187	19.00 b	1.09 a
ESP_ALT_HUE	0.42	0.27	0.22	0.77	0.00	0.23	0.51	63.08	21.60 b	35.90 b	1.46	200	8.64 c	1.50 b
ESP_ALT_TRI	0.48	0.42	0.26	0.67	0.21	0.13	0.57	63.48	21.00 b	40.00 b	1.31	196	4.89 a	1.60 b
ESP_CAN	0.51	0.44	0.35	0.62	0.09	0.28	0.94	46.91	32.90 b	28.30 b	1.76	179	10.80 a	3.30 a
ESP_GUA_VAL	0.50	0.30	0.25	0.71	0.00	0.29	0.68	69.09	24.80 b	40.90 b	1.27	200	12.00 a	3.80 a
ESP_LAS	0.24	0.26	0.07	0.43	0.45	0.13	1.63	37.89	1.00 a	70.00 a	1.65	197	10.30 a	3.60 a
ESP_MAJ_MAI	0.53	0.47	0.28	0.69	0.15	0.16	0.76	97.45	9.00 a	80.00 a	1.18	200	7.00 a	0.30 a
ESP_MON_SIE_NAT	0.38	0.33	0.40	0.49	0.05	0.45	0.62	63.05	20.80 b	41.90 b	1.45	200	22.00 a	3.30 b
ESP_RIN	0.82	0.61	0.60	0.96	0.00	0.04	0.85	76.30	15.00 a	9.00 a	2.17	200	7.40 a	3.40 a
ESP_RON_PIL	0.34	0.26	0.16	0.59	0.11	0.31	1.05	93.66	18.00 a	30.00 a	1.86	200	2.60 a	0.90 b
ESP_TIL_MIX	0.40	0.42	0.30	0.43	0.17	0.40	0.77	48.10	20.00 a	60.00 a	1.44	162	14.20 a	3.27 a
ESP_TIL_OAK	0.16	0.37	0.18	0.29	0.35	0.37	0.77	48.10	20.00 a	60.00 a	1.44	162	5.00 a	4.59 a
ESP_TIL_PIN	0.20	0.39	0.06	0.28	0.55	0.17	0.79	48.10	20.00 a	60.00 a	1.78	188	18.30 a	1.02 a

Table S4: Summary table of site level R_{VPD}^2 , R_{SWC}^2 , R_{PPFD}^2 , climate, soil properties and vegetation structure data. PPET is in [mm mm⁻¹], P-PET_{sd} is in [mm], Clay and Sand are in [%], Total N is in [g kg⁻¹], Stand height is in [m], LAI is in [m²_{leaves} m²_{soil}]. Letters show data source: a = SAPFLUXNET, b = Global rasters, c = SAPFLUXNET plant height. (continued)

Site code	R_{VPD}^2	R_{SWC}^2	R_{PPFD}^2	Relimp VPD	Relimp SWC	Relimp PPFD	PPET	P - PET _{sd}	Clay	Sand	Total N	Bedrock	Stand height	LAI
ESP_VAL_BAR	0.56	0.24	0.27	0.87	0.00	0.13	0.70	34.07	32.63 a	9.81 a	1.94	200	10.60 a	2.10 a
ESP_VAL_SOR	0.50	0.32	0.26	0.66	0.10	0.24	0.78	32.15	20.00 a	60.00 a	2.04	200	11.00 a	2.40 a
ESP_YUN_C1	0.29	0.44	0.17	0.17	0.67	0.16	0.83	93.65	29.00 a	22.00 a	1.37	197	10.60 a	2.20 b
ESP_YUN_C2	0.27	0.61	0.24	0.22	0.43	0.35	0.78	91.33	29.00 a	22.00 a	1.37	188	11.60 a	2.50 b
FIN_HYY_SME	0.51	0.01	0.10	0.61	0.10	0.29	1.20	38.32	6.50 a	37.00 a	1.67	200	18.00 a	1.30 a
FIN_PET	0.63	0.63	0.58	0.40	0.60	0.01	1.13	26.34	7.30 b	60.80 b	5.08	200	3.76 a	0.61 a
FRA_FON	0.68	0.62	0.64	0.72	0.22	0.06	0.89	45.10	19.00 a	37.00 a	1.26	200	28.00 a	6.00 a
FRA_HES_HE1_NON	0.42	0.53	0.43	0.41	0.26	0.33	1.31	47.72	25.00 a	8.00 a	1.41	200	12.80 a	6.00 a
FRA_HES_HE2_NON	0.25	0.35	0.12	0.45	0.27	0.28	1.31	47.72	25.00 a	8.00 a	1.41	200	13.00 a	6.00 a
FRA_PUE	0.40	0.47	0.27	0.46	0.27	0.27	1.27	70.16	39.00 a	26.00 a	1.69	195	5.00 a	2.40 a
GBR_ABE_PLO	0.28	0.26	0.21	0.51	0.23	0.25	1.92	47.48	10.00 a	60.00 a	3.70	179	10.00 a	6.00 a
GBR_DEV_CON	0.88	0.48	0.62	0.93	0.04	0.04	1.43	44.38	14.80 b	56.90 b	3.44	200	15.00 a	1.92 a
GBR_GUI_ST1	0.80	0.78	0.77	0.58	0.01	0.41	3.19	68.11	3.70 b	80.40 b	14.26	197	11.00 a	0.92 a
GBR_GUI_ST2	0.59	0.55	0.47	0.59	0.06	0.35	3.19	68.11	3.70 b	80.40 b	14.26	197	13.30 a	0.94 a
GBR_GUI_ST3	0.82	0.81	0.77	0.66	0.03	0.31	3.19	68.11	3.70 b	80.40 b	14.26	197	14.30 a	1.57 a
GUF_GUY_GUY	0.96	0.90	0.93	0.82	0.07	0.11	2.88	135.18	43.00 a	48.00 a	1.53	200	35.00 a	7.00 a
GUF_GUY_ST2	0.79	0.78	0.75	0.46	0.49	0.04	3.02	141.34	43.20 a	47.80 a	1.66	200	35.00 a	6.70 a
GUF_NOU_PET	0.81	0.55	0.71	1.00	0.00	0.00	2.69	158.16	59.20 a	33.20 a	2.22	200	35.00 a	5.50 a
HUN_SIK	0.79	0.36	0.48	0.93	0.01	0.06	0.70	39.64	30.40 b	44.00 b	1.64	200	20.00 a	7.00 a
ISR_YAT_YAT	0.28	0.32	0.14	0.43	0.57	0.00	0.28	83.43	28.00 a	31.00 a	0.71	178	11.00 a	1.70 a
ITA_FEL_S17	0.54	0.39	0.30	0.68	0.13	0.19	1.08	22.97	8.00 a	76.00 a	3.11	117	20.00 a	3.10 b
ITA_KAE_S20	0.62	0.47	0.47	0.72	0.06	0.22	1.24	22.97	17.00 a	50.00 a	3.64	121	14.00 a	2.60 b
ITA_MUN	0.56	0.39	0.42	0.74	0.22	0.04	0.80	29.87	7.00 a	55.00 a	1.93	188	18.00 a	2.20 b
ITA_REN	0.79	0.73	0.74	0.99	0.00	0.01	1.61	12.59	17.70 b	47.90 b	2.73	143	27.00 b	4.60 b
ITA_RUN_N20	0.78	0.71	0.71	0.88	0.00	0.12	1.39	15.28	14.00 a	54.00 a	3.33	123	18.70 a	5.70 b
MEX_COR_YP	0.68	0.23	0.31	0.79	0.05	0.16	1.42	81.77	22.20 b	46.40 b	2.94	200	7.00 a	5.20 a
NLD_LOO	0.18	0.12	0.12	0.79	0.00	0.21	1.33	41.67	1.00 a	99.00 a	2.61	200	18.00 a	2.20 a
NLD_SPE_DOU	0.75	0.59	0.63	0.85	0.03	0.12	1.42	39.80	4.80 b	80.70 b	1.62	200	30.00 a	4.50 a
NZL_HUA_HUA	0.65	0.61	0.59	0.70	0.15	0.15	2.62	42.52	71.20 a	13.20 a	1.73	200	27.00 a	6.60 b
PRT_LEZ_ARN	0.59	0.28	0.27	0.78	0.01	0.21	0.72	77.42	5.04 a	90.38 a	1.52	200	12.00 a	1.50 a
PRT_MIT	0.66	0.55	0.32	0.61	0.33	0.06	0.51	80.80	16.10 b	64.50 b	1.33	200	7.50 a	0.55 a
PRT_PIN	0.65	0.55	0.38	0.65	0.32	0.02	0.76	74.76	16.60 b	61.20 b	1.26	200	12.60 a	1.10 b
RUS_CHE_Y4	0.32	0.22	0.24	0.94	0.00	0.06	0.62	34.23	21.10 b	23.20 b	4.96	200	7.00 a	1.30 b
RUS_FYO	0.61	0.56	0.54	0.81	0.02	0.17	1.24	30.87	18.20 b	48.80 b	3.77	198	23.50 a	3.50 a
RUS_POG_VAR	0.70	0.50	0.58	0.81	0.00	0.19	0.70	33.02	28.60 b	37.50 b	2.64	200	22.00 a	2.80 b
SEN_SOU_PRE	0.64	0.40	0.22	0.66	0.34	0.01	0.13	43.94	6.00 a	90.00 a	0.23	200	7.00 a	0.22 a
SWE_NOR_ST1_BEf	0.74	0.65	0.64	0.61	0.28	0.10	1.07	36.70	5.80 a	58.60 a	2.63	185	28.70 a	4.18 a
SWE_NOR_ST2	0.32	0.29	0.23	0.55	0.02	0.44	1.07	36.70	5.80 a	58.60 a	2.63	185	27.70 a	6.15 a
SWE_NOR_ST3	0.55	0.59	0.56	0.48	0.22	0.30	1.07	36.70	5.80 a	58.60 a	2.63	185	27.20 a	4.55 a
SWE_NOR_ST5_REF	0.53	0.56	0.53	0.48	0.20	0.32	1.07	36.55	19.20 b	43.50 b	2.83	190	20.00 a	5.00 a
SWE_SKO_MIN	0.71	0.70	0.67	0.52	0.04	0.44	1.60	45.86	17.30 b	52.00 b	2.48	133	28.00 a	6.50 a
SWE_SKY_38Y	0.34	0.43	0.37	0.05	0.94	0.00	1.39	33.61	21.70 b	43.80 b	3.93	184	13.60 a	3.98 a
SWE_SKY_68Y	0.35	0.53	0.34	0.05	0.83	0.11	1.30	33.80	18.90 b	46.50 b	4.15	184	20.30 a	3.83 a
SWE_SVA_MIX_NON	0.65	0.54	0.57	0.78	0.22	0.00	1.33	34.34	0.50 a	92.50 a	1.67	200	15.00 a	3.80 b
THA_KHU	0.50	0.41	0.41	0.78	0.21	0.01	0.83	84.24	10.00 a	65.00 a	0.75	200	15.00 a	3.90 a
USA_BNZ_BLA	0.52	0.37	0.46	0.68	0.21	0.10	0.69	33.86	10.30 b	36.80 b	2.57	200	3.00 a	3.60 b
USA_CHE_ASP	0.67	0.32	0.30	0.91	0.03	0.06	1.23	20.06	12.00 a	74.00 a	1.52	200	10.00 a	4.50 a

Table S4: Summary table of site level R^2_{VPD} , R^2_{SWC} , R^2_{PPFD} , climate, soil properties and vegetation structure data. PPET is in [mm mm⁻¹], P-PET_{sd} is in [mm], Clay and Sand are in [%], Total N is in [g kg⁻¹], Stand height is in [m], LAI is in [m²_{leaves} m²_{soil}]. Letters show data source: a = SAPFLUXNET, b = Global rasters, c = SAPFLUXNET plant height. (continued)

Site code	R^2_{VPD}	R^2_{SWC}	R^2_{PPFD}	Relimp VPD	Relimp SWC	Relimp PPFD	PPET	P - PET _{sd}	Clay	Sand	Total N	Bedrock	Stand height	LAI
USA_CHE_MAP	0.57	0.52	0.52	0.76	0.06	0.18	1.22	19.85	6.63 a	59.31 a	2.54	200	18.00 a	3.90 a
USA_DUK_HAR	0.72	0.62	0.67	0.91	0.02	0.07	1.12	41.33	33.90 b	31.00 b	0.76	200	25.00 a	7.03 a
USA_HIL_HF2	0.75	0.71	0.74	0.61	0.00	0.39	1.14	37.46	26.00 a	43.00 a	0.71	200	15.00 a	5.50 a
USA_INM	0.40	0.35	0.38	0.56	0.00	0.44	1.18	39.20	26.70 b	8.00 b	1.05	200	30.00 a	4.90 a
USA_MOR_SF	0.65	0.58	0.49	0.90	0.09	0.01	1.18	39.20	30.00 a	10.00 a	1.05	200	27.00 a	5.00 a
USA_NWH	0.88	0.85	0.73	0.80	0.04	0.15	1.05	59.56	36.70 b	4.90 b	0.80	200	22.70 a	5.60 b
USA_ORN_ST1_AMB	0.63	0.62	0.53	0.51	0.10	0.39	1.14	61.36	24.00 a	21.00 a	0.85	200	17.90 a	5.50 a
USA_PAR_FER	0.43	0.17	0.22	0.69	0.04	0.27	1.32	25.96	10.00 a	60.00 a	1.75	200	18.00 a	4.20 a
USA_PER_PER	0.55	0.30	0.37	0.85	0.01	0.14	1.32	34.41	3.40 b	89.20 b	6.13	200	12.00 a	4.10 a
USA_PJS_P04_AMB	0.31	0.09	0.26	0.74	0.03	0.23	0.25	49.32	6.00 a	52.00 a	0.82	186	4.20 a	0.71 a
USA_PJS_P08_AMB	0.33	0.10	0.22	0.94	0.03	0.03	0.25	49.32	3.00 a	49.00 a	0.82	186	4.10 a	0.90 a
USA_PJS_P12_AMB	0.28	0.14	0.15	0.63	0.37	0.00	0.25	49.32	6.00 a	54.00 a	0.82	186	4.00 a	0.72 a
USA_SIL_OAK_1PR	0.38	0.40	0.36	0.29	0.58	0.13	1.36	38.70	1.00 a	98.00 a	0.74	200	9.50 a	3.60 a
USA_SIL_OAK_2PR	0.39	0.32	0.36	0.92	0.06	0.01	1.36	38.70	1.00 a	98.00 a	0.74	200	9.50 a	3.60 a
USA_SML_SER	0.51	0.37	0.37	0.67	0.32	0.01	1.03	40.05	28.70 b	30.90 b	0.82	200	40.00 a	5.80 b
USA_SWH	0.86	0.63	0.50	0.94	0.01	0.05	1.09	62.29	43.10 b	6.30 b	0.69	200	24.20 a	4.00 b
USA_SYL_HL1	0.46	0.36	0.38	0.97	0.03	0.00	1.27	25.01	8.90 b	51.00 b	1.41	200	27.00 a	5.40 b
USA_SYL_HL2	0.47	0.46	0.46	0.55	0.01	0.44	1.27	25.01	8.90 b	51.00 b	1.41	200	27.00 a	5.40 b
USA_TNB	0.25	0.27	0.24	0.41	0.12	0.46	1.39	48.33	21.60 b	34.90 b	0.84	200	25.00 a	4.70 a
USA_TNO	0.40	0.40	0.38	0.50	0.22	0.28	1.41	60.02	29.60 b	30.20 b	0.83	200	30.00 a	6.60 a
USA_TNP	0.33	0.36	0.31	0.40	0.37	0.23	1.41	61.60	31.60 b	26.60 b	0.81	200	25.00 a	4.50 a
USA_UMB_CON	0.51	0.39	0.38	0.79	0.03	0.18	1.30	30.60	1.00 a	92.00 a	2.02	200	29.00 a	3.50 a
USA_UMB_GIR	0.43	0.35	0.34	0.78	0.05	0.17	1.25	30.69	1.00 a	92.00 a	2.49	200	29.00 a	3.50 a
USA_WIL_WC1	0.33	0.18	0.16	0.82	0.16	0.02	1.19	20.23	6.90 b	53.20 b	1.01	200	24.30 a	6.20 b
USA_WVF	0.28	0.26	0.25	0.59	0.06	0.36	1.63	30.35	24.90 b	29.90 b	1.37	200	30.00 a	6.90 a
ZAF_FRA_FRA	0.43	0.08	0.14	0.92	0.00	0.08	0.90	99.17	20.00 b	69.90 b	0.95	200	20.00 a	1.80 a
ZAF_RAD	0.46	0.42	0.40	0.57	0.10	0.33	0.95	82.73	21.30 b	61.40 b	1.18	200	3.50 a	2.70 a
ZAF_SOU_SOU	0.39	0.22	0.21	0.59	0.06	0.35	0.97	86.39	23.00 b	61.90 b	1.13	200	4.00 a	3.00 a
ZAF_WEL_SOR	0.62	0.33	0.34	0.63	0.08	0.29	0.50	79.71	20.00 a	60.00 a	0.81	179	25.00 a	1.80 a