***New Phytologist* Supporting Information**

Article title: Age-dependent leaf physiology and consequences for crown-scale carbon uptake during the dry season in an Amazon evergreen forest

Authors: Loren P. Albert, Jin Wu, Neill Prohaska, Plinio Barbosa de Camargo, Travis E. Huxman, Edgard Tribuzy, Valeriy Y. Ivanov, Rafael Oliveira, Sabrina Garcia, Marielle Smith, Raimundo Cosme Oliveira Junior, Natalia Restrepo-Coupe, Rodrigo da Silva, Scott Stark, Giordane Martins, Deliane V. Penha, Scott R. Saleska

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The following Supporting Information is available for this article:

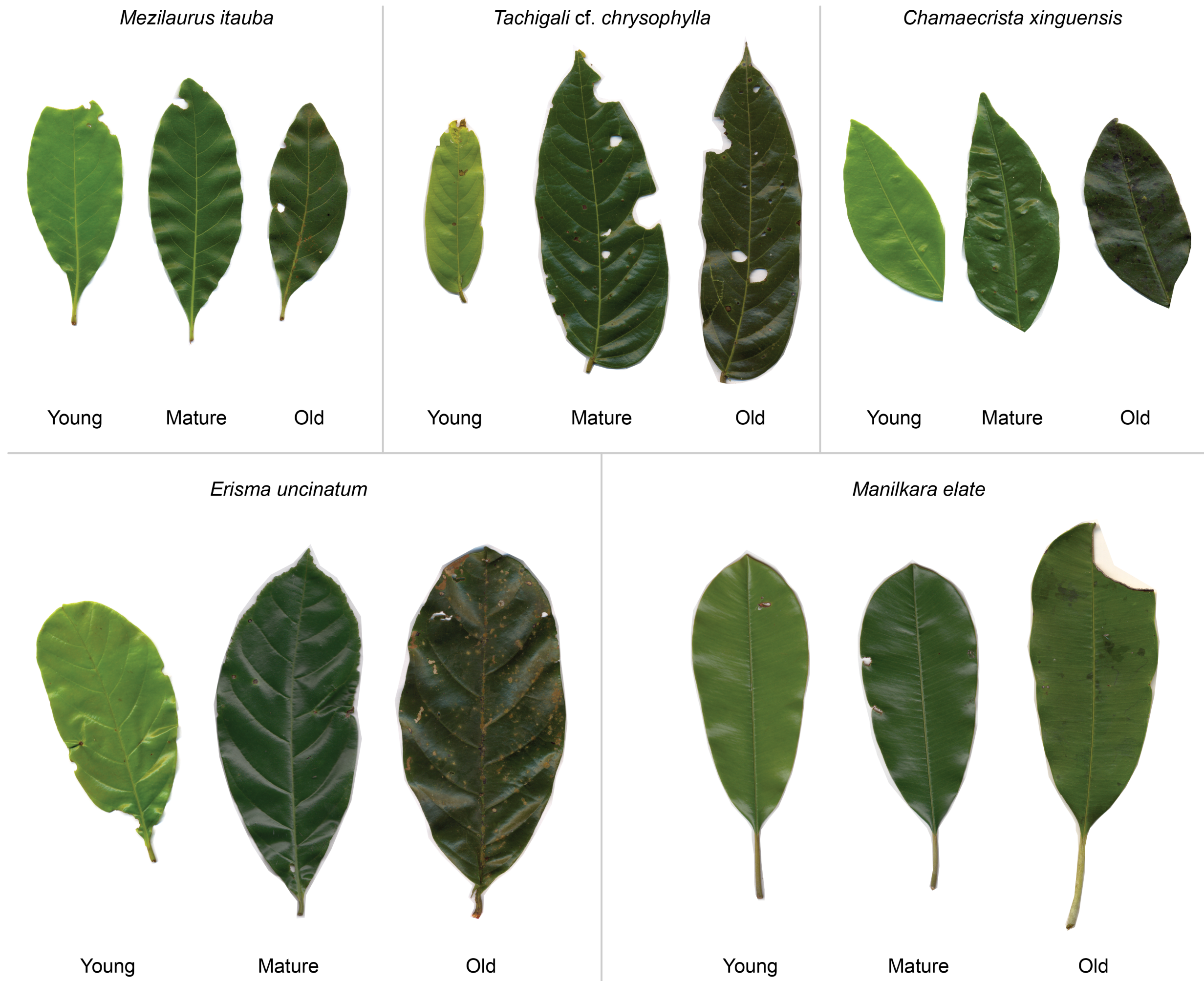

Fig. S1 Examples of leaves from each age category (young, mature and old) for trees used in leaf demography surveys (Fig. 5). Leaves on branches sampled for leaf demography were assigned age categories based on visual assessment of leaf color, size, rigidity, and also position in relation to other leaves and/or bud scars on the branch.

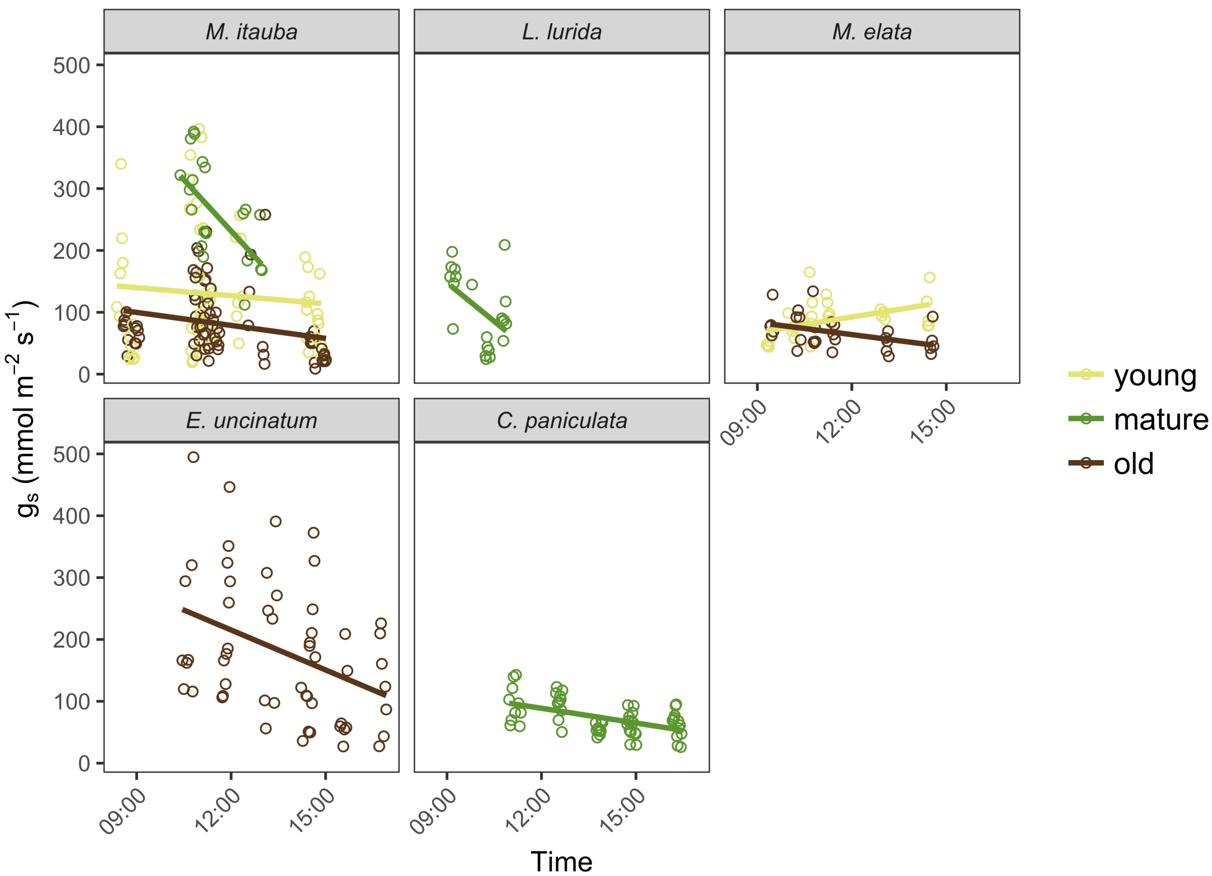

Fig. S2 Stomatal conductance (g_s) by leaf age and time of day for five trees early in the dry season (before October 15). Linear regression lines for g_s versus time of day are shown for visualization. All leaves age categories present on accessible branches at one to two points in the crown were measured for *M. itauba*, *M. elata* and *L. lurida*.

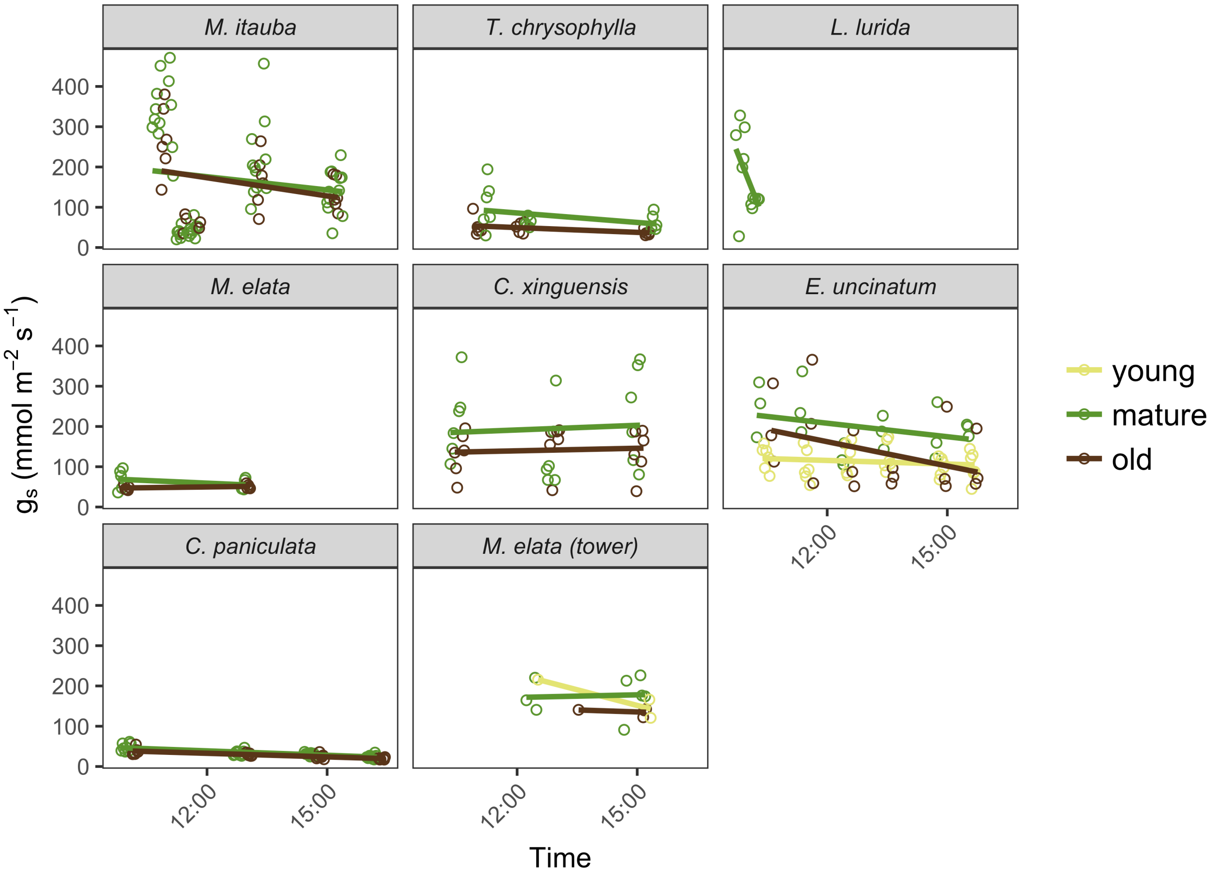

Fig. S3 Stomatal conductance (g_s) by leaf age and time of day for five trees late in the dry season (post- October 15). Linear regression lines for g_s versus time of day are shown for visualization. All leaves age categories present on accessible branches at one to two points in the crown were measured.

Table S1 Information for trees in the Tapajós National Forest that were studied for leaf demography and/or leaf physiology: species and family identification, and inventory tag number, height of tree, percent of basal area of trees identified as the same species, and which measurements the tree was used for. Species identification and inventory tag numbers were available as part of ongoing tree surveys (Pyle et al. 2008).

Species name	Family	Inventory Tag number	Height (m)	Percent of total basal area[1] identified as same species	Included in datasets[2,3]
Erisma uncinatum	Vochysiaceae	Transect 1; tag #9	34.6	12.79%	Gas exchange, stomatal conductance, chlorophyll extractions, leaf demography, leaf chemistry
Manilkara elata[4]	Sapotaceae	Transect 2; tag #500	37	7.84%	Gas exchange, stomatal conductance, chlorophyll extractions, leaf demography, leaf chemistry
Chamaecrista xinguensis[5]	Fabaceae	Transect 2; tag #504	27	6.63%	Gas exchange, stomatal conductance, chlorophyll extractions, leaf demography, leaf chemistry
Tachigali cf. chrysophylla[6]	Fabaceae	Transect 1; tag #118	44	4.26%	Gas exchange, stomatal conductance, leaf demography, leaf chemistry
Coussarea paniculata	Rubiaceae	No tag, but near tree with #9 tag.	Unknown but ~10	0.1%	Gas exchange, stomatal conductance, chlorophyll extractions, leaf chemistry
Mezilaurus itauba[7]	Lauraceae	Transect 1; tag #11	38	1.4%	Gas exchange, leaf demography, stomatal conductance, chlorophyll extractions, leaf chemistry
Manilkara elata[4]	Sapotaceae	No tag, but near walk-up tower	37.5	7.84%	Stomatal conductance
Lecythis lurida	Lecythidaceae	Transect 1; tag #14	Unknown	3.68%	Stomatal conductance

[1]Estimated from all trees >10 < 35 cm diameter at breast height in 3.99 hectares inventoried, and all trees ≥ 35 cm diameter at breast height in 19.75 hectares inventoried at KM 67 in the Tapajós National Forest. See Pyle et al. 2008 for species inventory details. Basal area for each tree in the 2012 inventory was estimated as πr^2, with r based on diameter at breast height/2. Then the percent basal area comprised by each species of tree studied was calculated. Note that for

percent basal area estimation, species identifications trees came from the KM 67 species inventory for consistency with taxonomic names used during the period of the inventory.

[2]Gas exchange includes instantaneous measurements and carbon dioxide response curves from cut and *in situ* measurements with Licor 6400.

[3]Stomatal conductance measured *in situ* with porometer. Stomatal conductance was also measured as part of gas exchange and also with Licor 6400 (see methods).

[4]Identified in KM 67 species inventory as *Manilkara huberi,* but updated by Flora of Brazil under construction (2020) with accepted name *Manilkara elata*.

[5]Identified in KM 67 species survey as *Chamaecrista xinguensis*, but recent identifications from Herbario IAN (EMBRAPA Belem) identified this tree as *Chamaecrista scleroxylon* (collection ID LPA-1). The Flora of Brazil under construction (2020) accepts both of these names.

[6]Identified in KM 67 species inventory as *Sclerolobium chrysophyllum*, an accepted synonym for *Tachigali chrysophylla* in the Taxonomic Name Resolution Service (Boyle *et al.* 2013). Most recent identifications from Herbario IAN (EMBRAPA Belem) identified the tree with tag 118 as *Tachigali eriopetala* (collection ID JWu-16).

[7]Herbario IAN (EMBRAPA Belem) alternatively identified this *Mezilaurus itauba* tree as *Ocotea sp.* (collection ID LPA-4).

Table S2. Net assimilation (A_{net}, with units μmol CO_2 m^{-2} s^{-1}) from early (before October 15) and late (after October 15) dry season sample size, mean, standard deviation, natural log of ratio of means (L_i), and corresponding sampling variance (v_i) for each tree. The LI-COR 6400 reference [CO_2] was 350 µmol mol^{-1} for $A_{net.}$ A cell with 'NA' indicates no value or no data.

Tree	**N early dry season**	**Mean A_{net} early dry season**	**SD early dry season**	**N late dry season**	**Mean A_{net} late dry season**	**SD late dry season**	**L_i**	**v_i**
Mezilaurus itauba	2	0.52	0.27	3	1.51	1.45	-1.07	0.44
Tachigali cf. chrysophylla	3	7.67	4.60	0	NA	NA	NA	NA
Manilkara elata	1	2.44	NA	3	0.64	0.89	1.34	NA
Chamaecrista xinguensis	3	7.64	1.50	5	5.60	2.40	0.31	0.05
Erisma uncinatum	3	5.69	0.41	7	3.43	1.12	0.50[a]	0.02
Coussarea paniculata	2	2.59	0.77	5	3.62	0.91	-0.33	0.06
Manilkara elata[1]	0	NA	NA	2	7.03	4.35	NA	NA

[1]Untagged tree accessible from walk-up tower (see Supporting Information Table S1).
[a]When individual trees were left out of meta-analysis one at a time to examine sensitivity of overall result to individual trees, the statistical significance of the z-value was sensitive to the inclusion of this tree.

Table S3 Young and mature leaf V_{cmax} (μmol CO_2 m^{-2} s^{-1}) estimated for 25 ºC, sample size, mean, standard deviation, natural log of ratio of means (L_i), and corresponding sampling variance (v_i) for each tree.

Tree	**N Young**	**Mean V_{cmax} Young**	**SD Young**	**N Mature**	**Mean V_{cmax} Mature**	**SD Mature**	**L_i**	**v_i**
Mezilaurus itauba	2	60.10	43.65	5	37.59	24.17	-0.47	0.35
Tachigali cf. chrysophylla	2	8.44	10.03	3	50.55	19.15	1.79	0.75
Manilkara elata	4	13.19	2.49	4	22.56	10.64	0.54	0.06
Chamaecrista xinguensis	3	14.26	5.81	8	34.72	9.66	0.89	0.06
Erisma uncinatum	9	15.72	5.24	11	25.74	6.84	0.49	0.02
Coussarea paniculata	4	7.78	2.55	7	20.49	2.40	0.97	0.03

Table S4 Mature and old leaf V_{cmax} (μmol CO_2 m^{-2} s^{-1}) estimated for 25 ºC, sample size, mean, standard deviation, natural log of ratio of means (L_i), and corresponding sampling variance (v_i) for each tree.

Tree	**N Mature**	**Mean V_{cmax} Mature**	**SD Mature**	**N Old**	**Mean V_{cmax} Old**	**SD old**	**L_i**	**v_i**
Mezilaurus itauba	5	37.59	24.17	3	17.82	7.26	0.75	0.14
Tachigali cf. chrysophylla	3	50.55	19.15	2	27.09	5.48	0.62	0.07
Manilkara elata	4	22.56	10.64	8	27.72	15.83	-0.21	0.10
Chamaecrista xinguensis	8	34.72	9.66	5	18.86	5.71	0.61	0.03
Erisma uncinatum	11	25.74	6.84	10	19.34	6.04	0.29	0.02
Coussarea paniculata	7	20.49	2.40	7	20.25	4.53	0.01	0.01

Table S5 Young and mature leaf J_{max} (μmol CO_2 m^{-2} s^{-1}) estimated for 25 ºC, sample size, mean, standard deviation, natural log of ratio of means (L_i), and corresponding sampling variance (v_i) for each tree.

Tree	**N Young**	**Mean J_{max} Young**	**SD Young**	**N Mature**	**Mean J_{max} Mature**	**SD Mature**	**L_i**	**v_i**
Mezilaurus itauba	2	82.26	40.76	5	59.39	27.28	-0.33	0.16
Tachigali cf. chrysophylla	2	24.91	23.96	3	77.13	9.89	1.13	0.47
Manilkara elata	4	27.98	8.70	4	49.19	31.10	0.56	0.12
Chamaecrista xinguensis	3	30.29	9.10	8	64.72	15.83	0.76	0.04
Erisma uncinatum	9	28.67	5.81	11	44.07	11.71	0.43	0.01
Coussarea paniculata	4	12.62	2.91	7	35.68	7.11	1.04	0.02

Table S6 Mature and old leaf J_{max} (μmol CO_2 m^{-2} s^{-1}) estimated for 25 ºC, sample size, mean, standard deviation, natural log of ratio of means (L_i), and corresponding sampling variance (v_i) for each tree.

Tree	**N Mature**	**Mean J_{max} Mature**	**SD Mature**	**N Old**	**Mean J_{max} Old**	**SD Old**	**L_i**	**v_i**
Mezilaurus itauba	5	59.39	27.28	3	38.07	10.87	0.44	0.07
Tachigali cf. chrysophylla	3	77.13	9.89	2	50.77	2.98	0.42	0.01
Manilkara elata	4	49.19	31.10	8	43.25	20.97	0.13	0.13
Chamaecrista xinguensis	8	64.72	15.83	5	34.55	5.17	0.63	0.01
Erisma uncinatum	11	44.07	11.71	10	34.25	8.73	0.25	0.01
Coussarea paniculata	7	35.68	7.11	7	33.93	3.49	0.05	0.01

Table S7 Young and mature leaf TPU (μmol CO_2 m^{-2} s^{-1}) estimated for 25 ºC, sample size, mean, standard deviation, natural log of ratio of means (L_i), and corresponding sampling variance (v_i) for each tree.

Tree	**N Young**	**Mean TPU Young**	**SD Young**	**N Mature**	**Mean TPU Mature**	**SD Mature**	**L_i**	**v_i**
Mezilaurus itauba	2	6.85	3.12	5	5.18	2.06	-0.28	0.14
Tachigali cf. chrysophylla	2	2.67	2.32	3	5.52	0.15	0.73	0.38
Manilkara elata	4	2.84	1.12	4	2.73	0.74	-0.04	0.06
Chamaecrista xinguensis	3	2.85	0.63	8	5.40	1.23	0.64	0.02
Erisma uncinatum	9	2.67	0.38	11	3.71	1.03	0.33	0.01
Coussarea paniculata	4	1.20	0.24	7	3.06	0.64	0.94	0.02

Table S8 Mature and old leaf TPU (μmol CO_2 m^{-2} s^{-1}) estimated for 25 ºC, sample size, mean, standard deviation, natural log of ratio of means (L_i), and corresponding sampling variance (v_i) for each tree.

Tree	N Mature	Mean TPU Mature	SD Mature	N Old	Mean TPU Old	SD Old	L_i	v_i
Mezilaurus itauba	5	5.18	2.06	3	3.47	0.71	0.40	0.05
Tachigali cf. chrysophylla	3	5.52	0.15	2	4.57	0.86	0.19	0.02
Manilkara elata	4	2.73	0.74	8	3.47	1.54	-0.24	0.04
Chamaecrista xinguensis	8	5.40	1.23	5	3.03	0.40	0.58	0.01
Erisma uncinatum	11	3.71	1.03	10	2.93	0.70	0.24	0.01
Coussarea paniculata	7	3.06	0.64	7	2.62	0.36	0.15	0.01

Table S9 Mature and old leaf stomatal conductance (mmol m^{-2} s^{-1}) measured *in situ* with a porometer late in the dry season (between Oct 15 – Dec 4), sample size, mean, standard deviation, natural log of ratio of means (Li), and corresponding sampling variance (vi) for each tree.

Tree	**N Mature**	**Mean g_s Mature**	**SD Mature**	**N Old**	**Mean g_s Old**	**SD Old**	**L_i**	**v_i**
Mezilaurus itauba	29	120.89	105.43	11	130.39	76.69	-0.08	0.06
Tachigali cf. chrysophylla	5	84.77	35.46	5	46.46	12.57	0.60	0.05
Manilkara elata	5	61.92	15.94	5	49.24	5.11	0.23	0.02
Chamaecrista xinguensis	6	194.28	91.06	6	141.32	49.97	0.32	0.06
Erisma uncinatum	3	197.53	24.65	3	137.89	37.57	0.36	0.03
Coussarea paniculata	11	32.61	4.06	7	27.94	5.99	0.15	0.01
Manilkara elata[1]	5	188.79	29.88	4	136.25	9.46	0.33	0.01

[1]Untagged tree accessible from walk-up tower (see Supporting Information Table S1).

Table S10 Young and mature leaf chlorophyll a:b ratio sample size, mean, standard deviation, natural log of ratio of means (L_i), and corresponding sampling variance (v_i) for each tree. A cell with 'NA' indicates no value or no data.

Tree	N Young	Mean Chlorophyll a:b Young	SD Young	N Mature	Mean Chlorophyll a:b Mature	SD Mature	L_i	v_i
Mezilaurus itauba	3	2.57	0.28	6	2.24	0.38	-0.14	0.01
Manilkara elata	0	NA	NA	4	2.20	0.52	NA	NA
Chamaecrista xinguensis	7	2.57	0.25	6	2.19	0.35	-0.16	0.01
Erisma uncinatum	3	3.15	0.09	6	2.38	0.54	-0.28	0.01
Coussarea paniculata	0	NA	NA	2	2.17	0.10	NA	NA

Table S11 Mature and old leaf chlorophyll a:b ratio sample size, mean, standard deviation, natural log of ratio of means (L_i), and corresponding sampling variance (v_i) for each tree. A cell with 'NA' indicates no value or no data.

Tree	**N Young**	**Mean Chlorophyll a:b Young**	**SD Young**	**N Mature**	**Mean Chlorophyll a:b Mature**	**SD Mature**	**L_i**	**v_i**
Mezilaurus itauba	6	2.24	0.38	0	NA	NA	NA	NA
Manilkara elata	4	2.20	0.52	3	1.24	0.24	0.58	0.03
Chamaecrista xinguensis	6	2.19	0.35	5	2.15	0.39	0.02	0.01
Erisma uncinatum	6	2.38	0.54	3	1.39	0.25	0.54	0.02
Coussarea paniculata	2	2.17	0.10	1	1.47	NA	0.39	NA

Table S12 Young and mature leaf total chlorophyll (chlorophyll a + chlorophyll b, with units µg g^{-1}) sample size, mean, standard deviation, natural log of ratio of means (L_i), and corresponding sampling variance (v_i) for each tree. A cell with 'NA' indicates no value or no data.

Tree	N Young	Mean Chlorophyll a + b Young	SD Young	N Mature	Mean Chlorophyll a + b Mature	SD Mature	L_i	v_i
Mezilaurus itauba	3	397.28	118.28	6	635.33	160.78	0.47	0.04
Manilkara elata	0	NA	NA	4	605.82	191.90	NA	NA
Chamaecrista xinguensis	7	193.12	91.74	6	282.54	67.12	0.38	0.04
Erisma uncinatum	3	267.95	5.45	6	567.68	190.63	0.75	0.02
Coussarea paniculata	0	NA	NA	2	335.16	136.89	NA	NA

Table S13 Mature and old leaf total chlorophyll (chlorophyll a + chlorophyll b, with units μg g^{-1}) sample size, mean, standard deviation, natural log of ratio of means (L_i), and corresponding sampling variance (v_i) for each tree. A cell with 'NA' indicates no value or no data.

Tree	**N Mature**	**Mean Chlorophyll a + b Mature**	**SD Mature**	**N Old**	**Mean Chlorophyll a + b Old**	**SD Old**	**L_i**	**v_i**
Mezilaurus itauba	6	635.33	160.78	0	NA	NA	NA	NA
Manilkara elata	4	605.82	191.90	3	868.68	92.60	-0.36	0.03
Chamaecrista xinguensis	6	282.54	67.12	5	269.24	108.33	0.05	0.04
Erisma uncinatum	6	567.68	190.63	3	837.33	24.50	-0.39	0.02
Coussarea paniculata	2	335.16	136.89	1	531.73	NA	-0.46	NA

Table S14 Young and mature leaf percent nitrogen sample size, mean, standard deviation, natural log of ratio of means (L_i), and corresponding sampling variance (v_i) for each tree. Note that *Coussarea paniculata* was not included in the meta-analysis contrasting young and mature leaves due to small sample size. A cell with 'NA' indicates no value or no data.

Tree	N Young	Mean % N Young	SD Young	N Mature	Mean % N Mature	SD Mature	L_i	v_i
Coussarea paniculata	1	2.22	NA	18	2.10	0.15	-0.06	NA
Mezilaurus itauba	20	2.66	0.71	34	2.73	0.26	0.03[a]	0.00
Tachigali cf. chrysophylla	7	2.33	0.43	41	2.26	0.22	-0.03[a]	0.01
Manilkara elata	6	1.33	0.09	75	1.59	0.19	0.18	0.00
Chamaecrista xinguensis	16	3.16	0.86	64	3.31	0.58	0.05[a]	0.01
Erisma uncinatum	95	1.67	0.28	55	1.56	0.11	-0.07	0.00

[a]When individual trees were left out of meta-analysis one at a time to examine sensitivity of overall result to individual trees, the statistical significance of the z-value was sensitive to the inclusion of this tree.

Table S15 Mature and old leaf percent nitrogen sample size, mean, standard deviation, natural log of ratio of means (L_i), and corresponding sampling variance (v_i) for each tree.

Tree	N Mature	Mean % N Mature	SD Mature	N Old	Mean % N Old	SD Old	L_i	v_i
Coussarea paniculata	18	2.10	0.15	8	1.91	0.07	0.09	0.00
Mezelaurus itauba	34	2.73	0.26	43	2.49	0.22	0.09	0.00
Tachigali cf. chrysophylla	41	2.26	0.22	32	1.92	0.23	0.16	0.00
Manilkara huberi	75	1.59	0.19	64	1.48	0.17	0.07	0.00
Chamaecrista xinguensis	64	3.31	0.58	40	3.22	0.69	0.03	0.00
Erisma uncinatum	55	1.56	0.11	69	1.55	0.19	0.01	0.00

Table S16 Young and mature leaf carbon to nitrogen ratio sample size, mean, standard deviation, natural log of ratio of means (L_i), and corresponding sampling variance (v_i) for each tree. Note that *Coussarea paniculata* was not included in the meta-analysis contrasting young and mature leaves due to small sample size. A cell with 'NA' indicates no value or no data.

Tree	**N Young**	**Mean C:N Young**	**SD Young**	**N Mature**	**Mean C:N Mature**	**SD Mature**	**L_i**	**v_i**
Coussarea paniculata	1	14.22	NA	18	15.84	0.95	0.11	NA
Mezilaurus itauba	20	20.35	5.33	34	18.88	1.99	-0.08[a]	0.00
Tachigali cf. chrysophylla	7	22.22	4.06	41	22.71	2.20	0.02[a]	0.01
Manilkara elata	6	36.42	3.85	75	32.55	4.20	-0.11[a]	0.00
Chamaecrista xinguensis	16	18.24	6.03	64	16.82	3.32	-0.08[a]	0.01
Erisma uncinatum	95	29.12	5.03	55	29.45	2.42	0.01	0.00

[a]When individual trees were left out of meta-analysis one at a time to examine sensitivity of overall result to individual trees, the statistical significance of the z-value was sensitive to the inclusion of this tree.

Table S17 Mature and old leaf carbon to nitrogen ratio sample size, mean, standard deviation, natural log of ratio of means (L_i), and corresponding sampling variance (v_i) for each tree.

Tree	N Mature	Mean C:N Mature	SD Mature	N Old	Mean C:N Old	SD Old	L_i	v_i
Coussarea paniculata	18	15.84	0.95	8	17.36	0.85	-0.09	0.00
Mezilaurus itauba	34	18.88	1.99	43	20.84	1.86	-0.10	0.00
Tachigali cf. chrysophylla	41	22.71	2.20	32	27.20	3.94	-0.18	0.00
Manilkara huberi	75	32.55	4.20	64	35.86	4.43	-0.10	0.00
Chamaecrista xinguensis	64	16.82	3.32	40	17.09	4.18	-0.02	0.00
Erisma uncinatum	55	29.45	2.42	69	30.30	4.70	-0.03	0.00

Table S18 Early (before October 15) versus late (after October 15) dry season number of young leaves on ~1 meter branches sample size, mean, standard deviation, natural log of ratio of means (L_i), and corresponding sampling variance (v_i) for each tree. Note that *Coussarea paniculata* was not included in the meta-analysis contrasting early and late dry season due to small sample size. A cell with 'NA' indicates no value or no data.

Tree	N branches in early dry season	Mean number of young leaves in early dry season	SD number of young leaves in early dry season	N branches in late dry season	Mean number of young leaves in late dry season	SD number of young in late dry season	L_i	v_i
Coussarea paniculata	1	2.00	NA	1	0.00	NA	NA	NA
Mezilaurus itauba	4	147.38	174.70	4	3.62	7.25	3.71[a]	1.35
Tachigali cf. chrysophylla	2	4.50	6.36	7	1.43	3.78	1.15	2.00
Manilkara elata	4	0.50	1.00	10	0.80	1.75	-0.47	1.48
Chamaecrista xinguensis	4	12.50	22.41	10	3.00	8.03	1.43	1.52
Erisma uncinatum	7	93.45	137.51	8	47.20	40.74	0.68	0.40

[a]When individual trees were left out of meta-analysis one at a time to examine sensitivity of overall result to individual trees, the statistical significance of the z-value was sensitive to the inclusion of this tree.

Table S19 Early (before October 15) versus late (after October 15) dry season number of mature leaves on ~1 meter branches sample size, mean, standard deviation, natural log of ratio of means (L_i), and corresponding sampling variance (v_i) for each tree. Note that *Coussarea paniculata* was not included in the meta-analysis contrasting early and late dry season due to small sample size. A cell with 'NA' indicates no value or no data.

Tree	N branches in early dry season	Mean number of mature leaves in early dry season	SD number of mature leaves in early dry season	N branches in late dry season	Mean number of mature leaves in late dry season	SD number of mature in late dry season	L_i	v_i
Coussarea paniculata	1	16.00	NA	1	24.00	NA	-0.41	NA
Mezilaurus itauba	4	514.88	486.27	4	663.33	264.87	-0.25	0.26
Tachigali cf. chrysophylla	2	158.50	224.15	7	313.99	133.76	-0.68	1.03
Manilkara elata	4	40.88	25.29	10	58.05	30.88	-0.35	0.12
Chamaecrista xinguensis	4	315.25	164.82	10	563.34	274.92	-0.58	0.09
Erisma uncinatum	7	102.43	94.01	8	269.33	188.99	-0.97	0.18

Table S20 Early (before October 15) versus late (after October 15) dry season number of old leaves on ~1 meter branches sample size, mean, standard deviation, natural log of ratio of means (L_i), and corresponding sampling variance (v_i) for each tree. Note that *Coussarea paniculata* was not included in the meta-analysis contrasting early and late dry season due to small sample size. A cell with 'NA' indicates no value or no data.

Tree	N branches in early dry season	Mean number of old leaves in early dry season	SD number of old leaves in early dry season	N branches in late dry season	Mean number of old leaves in late dry season	SD number of old in late dry season	L_i	v_i
Coussarea paniculata	1	13.60	NA	1	11.00	NA	0.21	NA
Mezilaurus itauba	4	147.50	140.16	4	17.12	11.39	2.15	0.34
Tachigali cf. chrysophylla	2	175.50	60.10	7	74.62	38.39	0.86	0.10
Manilkara elata	4	30.00	9.63	10	23.09	8.47	0.26	0.04
Chamaecrista xinguensis	4	99.50	105.56	10	40.65	43.72	0.90	0.40
Erisma uncinatum	7	140.21	121.74	8	30.44	22.51	1.53	0.18

Table S21 Intercept, slope, slope standard error (slope SE), slope t statistic and associated p-value for linear regressions of branch-level V_{cmax} (Supporting Information methods M4) versus day of year (DOY) for DOY 200 through DOY 350 for individual trees and aggregates (shade, sun, and all branches).

	Intercept	**Slope**	**Slope SE**	**Slope t statistic**	**p-value**
Shade branches					
Mezilaurus itauba	2.47	0.138	0.1480	0.93	0.45
Manilkara elata	21.33	-0.004	0.0034	-2.08	0.32
Chamaecrista xinguensis	19.62	0.032	0.0076	4.19	**<0.01**
Erisma uncinatum	10.34	0.039	0.0093	4.24	**0.01**
All tree shade branches (shade branch V_{cmax})	13.44	0.051	0.0371	1.38	0.26
Sun branches					
Mezilaurus itauba	28.12	-0.020	0.0079	-2.50	0.13
Tachigali cf. chrysophylla	-43.86	0.297	0.0436	6.81	**<0.01**
Manilkara elata	32.89	0.004	0.0069	0.55	0.61
Chamaecrista xinguensis	24.18	0.033	0.0216	1.52	0.188
Erisma uncinatum	11.39	0.041	0.0074	5.56	**<0.01**
All tree sun branches (sun branch-level V_{cmax})	10.54	0.071	0.0101	7.05	**<0.01**
All branches pooled					
Mezilaurus itauba	29.19	0.025	0.0427	0.59	0.58
Tachigali cf. chrysophylla	-12.22	0.178	0.0345	5.15	**<0.01**
Manilkara elata	26.67	-0.008	0.0051	-1.55	0.15
Chamaecrista xinguensis	20.82	0.039	0.0110	3.55	**<0.01**
Erisma uncinatum	10.22	0.042	0.0059	7.17	**<0.01**
All tree branches	14.93	0.056	0.0113	4.88	**<0.01**

Methods S1 Stem water potential

To examine general plant water status we present pre-dawn stem water potential (Fig 3c). To measure stem water potential, stem psychrometers (manufactured by ICT International Inc.) were installed in the *E. uncinatum* tree and the *T. cf. chrysophylla* tree in August 2012. The *T. cf. chrysophylla* stem water potential dataset extended until January 2013, and the *E. uncinatum* dataset extended to January 2014. Then an additional psychrometer was installed in the *C. xinguensis* tree in August 2014. We binned data for 5:30 AM (when temperatures were stable), filtered out data that was exactly zero MPa (because this likely indicated condensation in the sensor head), then calculated weekly averages for years with the most complete data: *E. uncinatum* in 2014, *T. cf. chrysophylla* in 2012, and *C. xinguensis* in 2014.

Methods S2 Chlorophyll concentration calculations

The following equations were used to determine the content of chlorophyll (Lichtenthaler 1987):
Chlorophyll a (ug/g) = $((12.25 \times A_{663}) - (2.79 \times A_{647})) \times V$;
Chlorophyll b (ug/g) = $((21.50 \times A_{647}) - (5.10 \times A_{663})) \times V$;
Chlorophyll a + b (ug/g) = $(7.15 \times A_{663}) + (18.71 \times A_{647}) \times V$;
Where A_{663} and A_{647} are absorbance measured at 663nm and 647nm respectively, and V is filtrate volume (20 ml).

Methods S3 Meta-analysis equations
All meta-analyses calculations were performed using the 'Metafor' package version 1.9-9 (Viechtbauer 2010) in R software.

For each tree *i*, the log response ratio was calculated as follows:

$$L_i = \ln(X_1) - \ln(X_2)$$

With variance of sample log response ratio:

$$v_i = \frac{(SD_1)^2}{n_1 X_1^{\,2}} + \frac{(SD_2)^2}{n_2 X_2^{\,2}}$$

Where X_2, SD_2, and n_2 are the mean, standard deviation, and sample size of mature leaves, and X_1, SD_1, and n_1 are the mean, standard deviation, and sample size of the contrasting age group (old leaves or young leaves) of tree *i*. In the case of 'early' and 'late' dry season contrasts, X_1, SD_1, and n_1 are the mean, standard deviation, and sample size of the number of leaves of an age group early in the dry season (before October 15) and X_2, SD_2, and n_2 are the mean, standard deviation, and sample size of the number of leaves of an age group late in the dry season. Note that Supporting Information Tables S2 through S19 show all means even though trees with less than one leaf per age category were not included in meta-analysis due to lack of variance.

The overall effect was a weighted estimation:

$$\bar{L} = \frac{\sum_{i=1}^{k} w_i L_i}{\sum_{i=1}^{k} w_i}$$

Where weights (w_i) are equal to $1/v_i$. The standard error of the overall effect was calculated as:

$$SE(\bar{L}) = \sqrt{\frac{1}{\sum_{i=1}^{k} w_i}}$$

The z-value (z) test statistics were calculated as $\bar{L}/SE(\bar{L})$, and p-value was for a two-tailed test. The back-transformed ratio estimate (RR) was calculated as:

$$e^{\bar{L}}$$

Methods S4 branch-level Vcmax calculations

Individual trees

We estimated branch-level V_{cmax} using the proportion of leaves from each leaf age category on a branch multiplied by mean V_{cmax} for that leaf age category for each tree individually:

$$V_{c\max,branch} = f_Y\left(V_{c\max,Y}\right) + f_M\left(V_{c\max,M}\right) + f_O\left(V_{c\max,O}\right) \quad \text{Eqn 1}$$

Where $V_{cmax,Branch}$ is branch-level V_{cmax}, f_Y is the proportion of young leaves on the sample branch, f_M is the proportion of mature leaves on the branch, f_O is the proportion of old leaves, $V_{cmax,Y}$ is the mean V_{cmax} of young leaves for a tree, $V_{cmax,M}$ is the mean V_{cmax} of mature leaves for a tree, $V_{cmax,O}$ is the mean V_{cmax} of old leaves for a tree. For each tree we fit a linear model in R for $V_{cmax,Branch}$ versus day of year (DOY) for the dry season period with adequate sampling (DOY 200 to DOY 350). We calculated branch-level V_{cmax} for sun, shade, and pooled sun and shade. For sun branch-level V_{cmax}, the terms f_Y, f_M, and f_O, came from sun-exposed branches, and $V_{cmax,Y}$, $V_{cmax,M}$, and $V_{cmax,O}$ came from sun-exposed leaves. For shade branches, the terms f_Y, f_M, and f_O, came from and shaded branches, and $V_{cmax,Y}$, $V_{cmax,M}$, and $V_{cmax,O}$ came from leaves that experienced predominantly shade. For pooled data, sun and shade leaf V_{cmax} was pooled before calculation of means for each age category, and f_Y, f_M, and f_O, came from both sun-exposed and shaded branches.

Aggregated across individual trees

The slope β and intercept α from the linear models of $V_{cmax,branch}$ ~ DOY for each tree were used to calculate a mean slope $\bar{\beta}$:

$$\bar{\beta} = \frac{1}{n}\sum_{i=1}^{n}\beta_i \quad \text{Eqn 2}$$

and mean intercept $\bar{\alpha}$:

$$\bar{\alpha} = \frac{1}{n}\sum_{i=1}^{n}\alpha_i \quad \text{Eqn 3}$$

for all sun branches (n = 5) and all shade branches (n = 4). To calculate the variance of $\bar{\beta}$, we used the variance from each linear model and the formula for the variance of weighted sums of uncorrelated variables:

$$Var\left(aX + bY\right) = a^2(Var(X)) + b^2(Var(Y)) + 2abCov\left(X,Y\right) \quad \text{Eqn 4}$$

Applying Eqn 4 to Eqn 2 and assuming uncorrelated variances implies:

$$Var(\bar{\beta}) = \frac{1}{n^2}\left(Var(\beta_1) + Var(\beta_2)\ldots Var(\beta_n)\right)$$ Eqn 5

To test if the overall slope ($\bar{\beta}$) of $V_{cmax,branch}$ versus DOY was significantly different from zero, we calculated the t-statistic:

$$T = \frac{\bar{\beta}}{\sqrt{Var(\bar{\beta})}}$$ Eqn 6

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