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Tropical tree height and crown allometries for the Barro Colorado Nature Monument, Panama: a comparison of alternative hierarchical models incorporating interspecific variation in relation to life history traits

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This supplement includes the following materials:

Section S1. Extra tables and figures.

Table S1. Sources of field measurement data for tree heights and crown dimensions, methods, site of measurement and the number of data points.

Table S2. Parameter estimates (median and 90% posterior interval) for predicting tree height (m) and crown area (m2) from trunk diameter (cm) for 162 species.

Table S3. Parameter estimates for all the hierarchical models for tree height allometry.

Table S4. Parameter estimates for all the hierarchical models for crown area allometry.

Figure S1. Tree height allometry for the 162 species analyzed, showing observations and fitted relationships.

Figure S2. Crown area allometry for the 162 species analyzed, showing observations and fitted relationships.

Figure S3. Extended version of Figure 4 in the main text showing the entire range of observed DBHs.

References

Section S2. Stan code used to fit alternative allometric models.

Table S1. Sources of field measurement data for tree heights and crown dimensions, methods, site of measurement and the number of data points. Where crown areas were not measured directly, they were estimated as pi times the geometric mean crown radius. Where two height measurement methods are listed, the telescoping pole was used on small individuals and the other method on larger individuals.

	Source (*name*)	Crown method	Height method	Site	Years	N Crowns	N Heights	Observers	Reference
1	O´Brien (*OBrienBCI1993*)	8 radii[1]	Telescoping pole[2] or tangent method[3]	BCI	1993	171	171	S. O'Brien	O'Brien et al. 1995
2	Spiro (*SpiroBCI1993*)	8 radii[1]	Telescoping pole[2] or tangent method[3]	BCI	1993	195	194	Spiro	Bohlman & O'Brien 2006
3	Thomas (*ThomasBCI2000*)	–	Telescoping pole[2] or tangent method[3]	BCI	2000	–	43	Thomas	Thomas (unpubl data)
4	Bohlman (*BohlmanBCI1997*)	8 radii[1]	Sine method[4]	BCI	1997	175	182	S. A. Bohlman	Bohlman & O'Brien 2006
5	Wright (*WrightBCI2007*)	8 radii[1]	Telescoping pole[2] or tangent method[3]	BCI	2007	760	824	M. C. Ruiz-Jaen & C. Salvador	Wright et al. 2010
6	Wright (*WrightGigante1998*)	–	Telescoping pole[2] or tangent method[3]	Gigante	1998-1999	–	4720	A. Peterson, C. Korine, O. Hernandez & R. Gonzalez	NA
7	Muller-Landau (*MullerLandauBCI1996*)	Longest diameter and perpendicular diameter[5]	Telescoping pole[2]	BCI	1996-1999	505	1019	H. Muller-Landau	NA
8	Muller-Landau (*MullerLandauBCI2000*)	–	Telescoping pole[2] or sine method[4]	BCI		–	2113	P. Ramos, P. Villareal	NA
9	Muller-Landau (*MullerLandauBCI2014*)	Photogrammetry [6]	Photogrammetry minus lidar DEM[7]	BCI	2014	619	619	J. Dandois	NA
	Total					2425	9885		

[1] The horizontal distance from the trunk to the vertical projection of the edge of the canopy was measured in eight compass directions 45 degrees apart, including magnetic north.

[2] Height measurements were made with a height-marked telescoping pole for individuals that could be reached by this pole (typically to 5 or 8 m height).

[3] The tangent method involves combining measurements of the angle to the top of the tree and the distance to the base of the tree and calculating height as the distance times the tangent of the angle, with corrections for the height of the observer relative to the base of the tree (see Larjavaara & Muller-Landau 2013). In early studies, the distance to the base of the tree was measured manually; in later studies, with a laser rangefinder.

[4] The sine method is based on measuring the distance to the highest leaf using a laser rangefinder and the angle of that measurement relative to horizontal, and calculating the height as the distance times the sine of the angle (note that the sine is 1 if the measurement is completely vertical), with corrections for the height of the observer relative to the base of the tree (see Larjavaara & Muller-Landau 2013 for details). Modern laser rangefinder models for forestry applications often return the vertical distance directly.

[5] The horizontal distance spanning the longest dimension of the crown was measured together with the perpendicular horizontal dimension of the crown at its widest point.

[6] Overlapping aerial photos taken by an unmanned aerial vehicle in October 2014 were processed using Agisoft Photoscan to obtain a 3D point cloud, from which orthomosaics and canopy surface elevation maps were produced at a resolution of 7 cm (Dandois & Ellis 2013; Graves et al. 2018). The orthomosaic and canopy surface maps were georeferenced by comparison with 2009 1-m resolution airborne lidar data. Individual tree crowns greater than 50 m^2 in area were manually delineated, and were assigned to tagged trees in the 50 ha forest dynamics plot through ground-based field work that also assessed whether they were fully sun-exposed. For fully sun-exposed individuals, crown area was estimated as the area of the delineated crown.

[7] A 1-m ground digital elevation model from airborne LiDAR (2009) was subtracted from the canopy surface elevation calculated from the aerial photos as above to obtain a map of canopy height across the 50 ha plot. For each delineated crown linked to a tagged, fully sun-exposed tree, tree height was assessed as the maximum canopy height within the delineated crown area.

Table S2. Posterior, species-level parameter estimates (median and 90% posterior interval) for predicting tree height (m) and crown area (m^2) from trunk diameter (cm) for the focal species. Unbiased estimates of tree height and crown area can be obtained by multiplying the values predicted by these equations by 1.017 in the case of heights, and 1.163 for crown area, to correct for the bias from back-transforming predicted values of log height and log crown area (Sprugel, 1983). Species taxonomy and mnemonics according to Condit et al. (2017).

		Tree height (generalized Michaelis-Menten, Eq. 3)			***Crown area (power function, Eq. 2)***	
Mnemonic	**Species**	**a**	**b**	**k**	**a**	**b**
ade1tr	Adelia triloba	57.1 (48.1, 67.9)	0.66 (0.55, 0.77)	23.2 (17.7, 29.1)	0.800 (0.371, 1.783)	1.34 (1.07, 1.60)
alchco	Alchornea costaricensis	53.0 (44.4, 63.3)	0.64 (0.57, 0.72)	18.8 (15.0, 23.2)	0.553 (0.255, 1.203)	1.33 (1.11, 1.55)
allops	Allophylus psilospermus	57.9 (48.9, 69.0)	0.74 (0.63, 0.85)	22.0 (16.6, 28.0)	0.660 (0.302, 1.415)	1.35 (1.10, 1.62)
alsebl	Alseis blackiana	56.2 (48.6, 65.0)	0.73 (0.71, 0.77)	21.7 (18.8, 25.0)	0.228 (0.195, 0.265)	1.49 (1.42, 1.54)
amaico	Amaioua corymbosa	63.0 (53.0, 75.3)	0.70 (0.62, 0.77)	20.7 (16.9, 25.3)	0.721 (0.378, 1.452)	1.30 (1.04, 1.53)
anacex	Anacardium excelsum	48.5 (42.8, 56.3)	0.82 (0.70, 0.95)	17.6 (11.1, 24.3)	0.611 (0.262, 1.387)	1.32 (1.15, 1.50)
andiin	Andira inermis	63.5 (53.6, 75.5)	0.74 (0.64, 0.84)	24.6 (18.7, 31.0)	0.444 (0.187, 1.051)	1.38 (1.12, 1.64)
annoac	Annona acuminata	62.2 (52.1, 74.5)	0.72 (0.59, 0.84)	23.5 (18.0, 29.4)	0.669 (0.364, 1.258)	1.32 (1.08, 1.55)
apeime	Apeiba membranacea	53.9 (46.2, 62.9)	0.71 (0.65, 0.78)	18.5 (15.6, 21.6)	0.997 (0.454, 2.338)	1.15 (0.95, 1.34)
apeiti	Apeiba tibourbou	42.5 (34.5, 52.3)	0.78 (0.65, 0.90)	18.7 (12.9, 25.3)	0.562 (0.239, 1.299)	1.34 (1.09, 1.59)
ardife	Ardisia standleyana	62.3 (52.3, 74.2)	0.62 (0.53, 0.72)	22.4 (17.9, 27.3)	0.737 (0.380, 1.415)	1.32 (1.07, 1.55)
aspicr	Aspidosperma desmanthum	62.5 (54.6, 72.4)	0.77 (0.72, 0.82)	19.6 (17.2, 22.5)	0.692 (0.328, 1.515)	1.24 (1.05, 1.42)
ast2gr	Astronium graveolens	63.9 (55.3, 74.9)	0.79 (0.72, 0.85)	23.7 (19.8, 28.1)	0.578 (0.234, 1.282)	1.30 (1.09, 1.53)
beilpe	Beilschmiedia tovarensis	52.4 (47.2, 58.4)	0.91 (0.88, 0.95)	26.9 (24.2, 30.1)	0.583 (0.500, 0.677)	1.27 (1.21, 1.33)
brosal	Brosimum alicastrum	63.2 (56.4, 71.2)	0.80 (0.77, 0.84)	29.4 (26.5, 32.9)	0.939 (0.795, 1.116)	1.28 (1.22, 1.33)
brosgu	Brosimum guianense	62.0 (52.5, 73.6)	0.71 (0.64, 0.78)	19.6 (16.2, 23.5)	0.790 (0.458, 1.364)	1.30 (1.10, 1.51)
calolo	Calophyllum longifolium	61.1 (53.3, 71.0)	0.74 (0.69, 0.79)	20.7 (17.8, 24.1)	0.495 (0.267, 0.911)	1.37 (1.22, 1.52)
caseac	Casearia aculeata	61.7 (52.1, 73.4)	0.74 (0.63, 0.85)	23.1 (17.6, 29.0)	0.603 (0.302, 1.189)	1.34 (1.09, 1.57)
casear	Casearia arborea	56.4 (47.1, 68.3)	0.67 (0.59, 0.76)	17.3 (13.5, 21.9)	0.624 (0.262, 1.473)	1.29 (1.06, 1.53)
casesy	Casearia sylvestris	57.7 (48.4, 68.4)	0.69 (0.58, 0.79)	22.6 (16.7, 28.9)	0.594 (0.262, 1.389)	1.34 (1.10, 1.60)
cassel	Cassipourea elliptica	59.9 (51.2, 70.4)	0.74 (0.69, 0.80)	23.5 (19.7, 27.9)	0.536 (0.313, 0.908)	1.39 (1.21, 1.56)
cavapl	Cavanillesia platanifolia	51.7 (45.5, 60.2)	0.77 (0.68, 0.87)	16.9 (12.5, 22.0)	0.524 (0.220, 1.245)	1.21 (1.04, 1.39)
cecrin	Cecropia insignis	47.1 (41.6, 54.1)	0.96 (0.90, 1.03)	22.9 (20.3, 25.9)	0.254 (0.195, 0.328)	1.65 (1.56, 1.75)
cecrob	Cecropia obtusifolia	40.1 (32.3, 50.2)	0.88 (0.71, 1.05)	12.4 (7.1, 18.8)	0.665 (0.304, 1.678)	1.20 (0.93, 1.44)
ceibpe	Ceiba pentandra	53.6 (48.1, 60.7)	0.79 (0.72, 0.88)	23.8 (20.2, 28.1)	0.288 (0.143, 0.576)	1.51 (1.36, 1.65)
celtsc	Celtis schippii	58.8 (50.2, 69.6)	0.76 (0.69, 0.83)	20.8 (17.2, 25.1)	0.633 (0.277, 1.434)	1.37 (1.14, 1.63)
chr2ar	Chrysophyllum argenteum	57.6 (49.7, 66.3)	0.79 (0.75, 0.84)	27.0 (23.4, 31.3)	0.758 (0.625, 0.924)	1.24 (1.13, 1.35)
chr2ca	Chrysophyllum cainito	63.0 (53.6, 75.8)	0.75 (0.65, 0.85)	22.3 (15.7, 29.3)	0.585 (0.243, 1.405)	1.36 (1.14, 1.58)
phoeci	Cinnamomum triplinerve	55.3 (47.2, 65.4)	0.72 (0.65, 0.81)	19.2 (15.2, 23.6)	0.291 (0.133, 0.659)	1.39 (1.14, 1.64)
conoci	Conostegia cinnamomea	56.9 (48.3, 67.0)	0.71 (0.55, 0.86)	24.7 (20.4, 29.6)	1.380 (0.871, 2.189)	1.15 (0.94, 1.36)
cordal	Cordia alliodora	56.6 (48.7, 66.4)	0.82 (0.74, 0.91)	21.0 (17.0, 25.6)	0.530 (0.221, 1.312)	1.29 (1.05, 1.53)
cordbi	Cordia bicolor	49.9 (42.5, 57.9)	0.86 (0.82, 0.92)	23.9 (20.5, 27.6)	0.270 (0.216, 0.335)	1.44 (1.35, 1.53)
cordla	Cordia lasiocalyx	58.3 (49.4, 69.1)	0.64 (0.57, 0.71)	20.1 (16.4, 24.5)	0.340 (0.200, 0.581)	1.36 (1.16, 1.56)
cou2cu	Coussarea curvigemmia	57.1 (49.1, 66.2)	0.74 (0.68, 0.80)	24.2 (20.3, 28.3)	0.577 (0.360, 0.955)	1.31 (1.12, 1.50)
crotbi	Croton billbergianus	50.0 (42.0, 59.8)	0.77 (0.66, 0.87)	18.9 (14.4, 23.8)	0.732 (0.336, 1.627)	1.34 (1.09, 1.59)
cupala	Cupania latifolia	55.9 (47.3, 66.5)	0.73 (0.63, 0.83)	21.9 (15.9, 27.9)	0.612 (0.267, 1.418)	1.36 (1.13, 1.60)
cupasy	Cupania seemannii	61.4 (51.3, 73.1)	0.65 (0.57, 0.73)	19.4 (15.6, 23.8)	0.800 (0.436, 1.430)	1.36 (1.15, 1.59)
nectpu	Damburneya umbrosa	55.0 (46.7, 64.9)	0.74 (0.68, 0.80)	19.5 (16.1, 23.3)	0.665 (0.319, 1.384)	1.34 (1.09, 1.57)
dendar	Dendropanax arboreus	57.1 (48.6, 68.0)	0.71 (0.62, 0.79)	24.1 (18.6, 30.2)	0.531 (0.243, 1.112)	1.38 (1.18, 1.59)
des2pa	Desmopsis panamensis	60.1 (51.4, 70.6)	0.67 (0.63, 0.71)	22.7 (19.2, 26.9)	0.603 (0.362, 1.016)	1.34 (1.13, 1.54)
dio2ar	Diospyros artanthifolia	58.8 (49.5, 70.0)	0.67 (0.60, 0.74)	17.8 (14.4, 21.8)	0.470 (0.202, 1.043)	1.35 (1.09, 1.61)
diptpa	Dipteryx oleifera	64.5 (57.4, 74.4)	0.80 (0.73, 0.87)	23.0 (19.5, 26.8)	0.530 (0.222, 1.178)	1.47 (1.30, 1.67)
drypst	Drypetes standleyi	55.4 (47.4, 64.3)	0.78 (0.75, 0.82)	22.6 (19.5, 26.2)	0.794 (0.679, 0.933)	1.27 (1.19, 1.34)

Table S2. (*continued*).

		Tree height (generalized Michaelis-Menten, Eq. 3)			*Crown area (power function, Eq. 2)*	
Mnemonic	**Species**	**a**	**b**	**k**	**a**	**b**
entesc	Enterolobium schomburgkii	55.5 (46.8, 66.3)	0.77 (0.65, 0.89)	18.9 (13.8, 24.4)	0.880 (0.452, 1.830)	1.23 (0.99, 1.46)
ery2ma	Erythroxylum macrophyllum	60.6 (51.2, 72.1)	0.68 (0.57, 0.79)	23.0 (17.4, 29.3)	0.544 (0.266, 1.202)	1.35 (1.08, 1.61)
eugeco	Eugenia coloradoensis	62.5 (53.4, 74.3)	0.75 (0.69, 0.81)	22.1 (18.4, 26.7)	0.560 (0.273, 1.126)	1.35 (1.12, 1.57)
eugega	Eugenia galalonensis	61.8 (52.7, 73.2)	0.71 (0.64, 0.78)	22.0 (18.0, 26.6)	0.598 (0.341, 1.030)	1.33 (1.14, 1.54)
eugene	Eugenia nesiotica	61.8 (51.9, 73.6)	0.72 (0.63, 0.81)	24.4 (18.9, 30.5)	0.650 (0.277, 1.386)	1.38 (1.15, 1.63)
eugeoe	Eugenia oerstediana	54.8 (46.9, 63.1)	0.77 (0.73, 0.81)	26.9 (23.0, 31.1)	0.803 (0.632, 1.020)	1.34 (1.23, 1.45)
faraoc	Faramea occidentalis	59.1 (50.0, 69.2)	0.65 (0.61, 0.68)	20.5 (17.2, 24.3)	0.663 (0.489, 0.902)	1.25 (1.12, 1.38)
ficuc2	Ficus costaricana	59.6 (50.6, 71.1)	0.70 (0.61, 0.79)	23.4 (17.0, 30.2)	0.564 (0.233, 1.391)	1.18 (0.98, 1.37)
ficuma	Ficus maxima	51.6 (43.7, 61.8)	0.81 (0.69, 0.93)	19.5 (14.5, 25.3)	0.382 (0.183, 0.767)	1.41 (1.17, 1.65)
ficuto	Ficus tonduzii	58.3 (49.3, 69.2)	0.66 (0.56, 0.77)	23.3 (18.0, 29.2)	0.573 (0.260, 1.282)	1.33 (1.07, 1.60)
ficutr	Ficus trigonata	48.5 (41.8, 57.3)	0.81 (0.70, 0.93)	20.4 (15.1, 26.3)	0.651 (0.314, 1.392)	1.30 (1.13, 1.49)
ficuyo	Ficus yoponensis	44.1 (37.5, 53.4)	0.86 (0.74, 1.00)	16.7 (12.2, 22.2)	0.491 (0.249, 0.937)	1.44 (1.27, 1.61)
gar2ma	Garcinia madruno	58.0 (49.4, 68.1)	0.72 (0.67, 0.77)	22.8 (19.3, 26.9)	0.616 (0.275, 1.396)	1.36 (1.09, 1.63)
gar2in	Garcinia recondita	57.6 (49.8, 66.6)	0.77 (0.73, 0.81)	26.7 (22.9, 30.9)	0.819 (0.675, 0.985)	1.26 (1.15, 1.38)
geniam	Genipa americana	63.8 (53.3, 77.4)	0.66 (0.57, 0.76)	24.0 (18.0, 30.5)	0.594 (0.249, 1.327)	1.40 (1.16, 1.65)
guapst	Guapira standleyana	64.4 (55.0, 76.4)	0.70 (0.65, 0.77)	21.9 (18.2, 26.1)	0.597 (0.280, 1.353)	1.29 (1.09, 1.49)
guarsp	Guarea bullata	61.9 (52.5, 73.2)	0.70 (0.63, 0.77)	23.9 (19.8, 28.5)	0.263 (0.141, 0.474)	1.44 (1.25, 1.67)
guargr	Guarea grandifolia	59.3 (50.4, 70.1)	0.74 (0.64, 0.84)	21.8 (15.5, 28.6)	0.601 (0.256, 1.403)	1.34 (1.13, 1.55)
guargu	Guarea guidonia	60.5 (50.5, 73.1)	0.60 (0.53, 0.66)	19.5 (15.5, 23.9)	0.517 (0.239, 1.100)	1.32 (1.10, 1.54)
guatdu	Guatteria lucens	65.0 (55.8, 76.5)	0.74 (0.68, 0.81)	22.0 (18.2, 26.4)	0.635 (0.314, 1.253)	1.29 (1.10, 1.47)
guazul	Guazuma ulmifolia	48.3 (39.7, 58.2)	0.70 (0.62, 0.79)	15.4 (12.0, 19.4)	0.618 (0.275, 1.462)	1.30 (1.08, 1.52)
gustsu	Gustavia superba	54.6 (46.0, 65.2)	0.69 (0.59, 0.78)	21.8 (16.8, 27.4)	0.615 (0.275, 1.364)	1.31 (1.08, 1.52)
tab1gu	Handroanthus guayacan	58.4 (51.1, 67.5)	0.80 (0.74, 0.86)	25.6 (22.4, 29.4)	0.388 (0.210, 0.685)	1.37 (1.23, 1.53)
hassfl	Hasseltia floribunda	60.7 (51.1, 72.1)	0.54 (0.47, 0.62)	20.3 (16.0, 25.2)	0.683 (0.339, 1.410)	1.28 (1.04, 1.50)
heisac	Heisteria acuminata	58.9 (49.9, 69.6)	0.66 (0.61, 0.71)	20.5 (17.0, 24.3)	0.875 (0.439, 1.822)	1.32 (1.04, 1.57)
heisco	Heisteria concinna	48.2 (39.4, 57.5)	0.68 (0.65, 0.72)	15.7 (12.8, 18.8)	0.652 (0.370, 1.153)	1.37 (1.18, 1.55)
hyeral	Hieronyma alchorneoides	64.3 (55.3, 76.2)	0.70 (0.64, 0.77)	23.0 (18.9, 27.4)	0.554 (0.234, 1.337)	1.38 (1.19, 1.58)
hirtam	Hirtella americana	59.3 (49.9, 71.0)	0.62 (0.56, 0.68)	17.6 (14.2, 21.5)	0.485 (0.254, 0.904)	1.42 (1.17, 1.67)
hirttr	Hirtella triandra	57.3 (48.9, 67.2)	0.71 (0.68, 0.74)	23.3 (19.8, 27.3)	0.927 (0.768, 1.130)	1.25 (1.14, 1.36)
ingas1	Inga acuminata	54.6 (45.5, 65.2)	0.67 (0.57, 0.77)	18.7 (13.6, 24.5)	0.735 (0.366, 1.456)	1.40 (1.17, 1.62)
ingago	Inga goldmanii	59.0 (49.8, 70.2)	0.72 (0.62, 0.82)	23.1 (17.1, 29.5)	0.639 (0.271, 1.454)	1.37 (1.13, 1.61)
ingama	Inga marginata	56.1 (47.2, 67.2)	0.69 (0.61, 0.77)	17.5 (13.8, 21.8)	0.658 (0.264, 1.504)	1.40 (1.17, 1.66)
ingasa	Inga sapindoides	58.3 (49.5, 69.3)	0.74 (0.64, 0.83)	22.9 (17.2, 29.0)	0.657 (0.295, 1.463)	1.38 (1.13, 1.63)
ingasp	Inga spectabilis	53.5 (45.3, 63.6)	0.73 (0.62, 0.83)	22.1 (16.3, 28.3)	0.541 (0.233, 1.231)	1.37 (1.12, 1.61)
ingaum	Inga umbellifera	63.5 (53.0, 76.4)	0.59 (0.51, 0.66)	17.2 (14.0, 21.2)	0.881 (0.408, 1.959)	1.32 (1.05, 1.57)
jac1co	Jacaranda copaia	51.4 (45.1, 60.0)	0.75 (0.68, 0.83)	14.6 (12.3, 17.1)	0.500 (0.269, 0.977)	1.36 (1.20, 1.52)
laciag	Lacistema aggregatum	62.0 (52.5, 73.8)	0.71 (0.66, 0.77)	21.9 (18.3, 26.4)	0.467 (0.198, 1.074)	1.35 (1.09, 1.63)
lacmpa	Lacmellea panamensis	53.4 (44.9, 63.6)	0.69 (0.62, 0.77)	17.4 (14.0, 21.3)	0.538 (0.245, 1.371)	1.31 (1.06, 1.55)
laetpr	Laetia procera	48.2 (40.6, 57.8)	0.81 (0.71, 0.93)	17.2 (13.2, 21.8)	0.591 (0.253, 1.422)	1.40 (1.16, 1.63)
laetth	Laetia thamnia	60.3 (50.8, 72.1)	0.65 (0.59, 0.70)	18.0 (14.8, 21.7)	0.705 (0.311, 1.577)	1.38 (1.10, 1.65)
licahy	Licania hypoleuca	62.5 (52.6, 74.2)	0.67 (0.63, 0.71)	20.7 (17.2, 24.8)	0.725 (0.323, 1.560)	1.36 (1.11, 1.61)
licapl	Licania platypus	61.0 (51.7, 72.8)	0.72 (0.63, 0.82)	23.4 (17.5, 29.7)	0.639 (0.310, 1.432)	1.24 (1.00, 1.44)
lindla	Lindackeria laurina	57.4 (48.2, 68.6)	0.71 (0.60, 0.80)	23.3 (17.5, 29.3)	0.488 (0.219, 1.090)	1.35 (1.10, 1.59)
loncla	Lonchocarpus heptaphyllus	63.9 (54.5, 75.5)	0.75 (0.70, 0.81)	21.4 (17.8, 25.7)	0.189 (0.112, 0.320)	1.53 (1.38, 1.70)
luehse	Luehea seemannii	55.1 (48.7, 62.9)	0.78 (0.74, 0.83)	26.9 (23.6, 30.5)	0.526 (0.230, 1.262)	1.33 (1.13, 1.52)
macrgl	Macrocnemum roseum	59.4 (50.2, 70.6)	0.71 (0.61, 0.81)	23.7 (17.6, 30.0)	0.569 (0.247, 1.312)	1.30 (1.06, 1.54)

Table S2. (*continued*).

		Tree height (generalized Michaelis-Menten, Eq. 3)			*Crown area (power function, Eq. 2)*	
Mnemonic	**Species**	**a**	**b**	**k**	**a**	**b**
maquco	Maquira guianensis	59.1 (50.2, 69.5)	0.68 (0.63, 0.74)	21.2 (17.6, 25.4)	0.517 (0.297, 0.902)	1.33 (1.12, 1.53)
mar1la	Marila laxiflora	56.2 (48.0, 65.9)	0.64 (0.51, 0.77)	23.0 (19.1, 27.6)	0.647 (0.406, 1.032)	1.33 (1.13, 1.52)
maytsc	Maytenus schippii	61.4 (51.8, 73.6)	0.75 (0.64, 0.85)	21.7 (15.5, 28.0)	0.525 (0.226, 1.230)	1.34 (1.07, 1.61)
micoar	Miconia argentea	50.8 (42.7, 60.1)	0.79 (0.74, 0.85)	18.2 (15.3, 21.7)	0.626 (0.480, 0.814)	1.34 (1.22, 1.46)
micone	Miconia nervosa	54.9 (46.3, 64.2)	0.70 (0.56, 0.84)	24.3 (19.9, 29.2)	0.862 (0.556, 1.301)	1.26 (1.06, 1.46)
malmsp	Mosannona garwoodii	60.1 (50.8, 70.9)	0.70 (0.65, 0.76)	20.4 (16.9, 24.3)	0.468 (0.212, 1.030)	1.37 (1.11, 1.62)
mourmy	Mouriri myrtilloides	62.5 (52.7, 74.2)	0.51 (0.46, 0.57)	19.4 (16.2, 23.4)	0.898 (0.579, 1.406)	1.32 (1.12, 1.53)
myrcga	Myrcia splendens tip. gatunensis	61.2 (51.5, 73.5)	0.64 (0.56, 0.72)	17.8 (14.3, 21.8)	0.642 (0.325, 1.301)	1.34 (1.08, 1.58)
myrofr	Myrospermum frutescens	66.4 (55.8, 79.6)	0.76 (0.65, 0.86)	20.7 (14.6, 27.4)	0.423 (0.180, 0.923)	1.47 (1.24, 1.73)
nectci	Nectandra cissiflora	55.6 (46.3, 66.4)	0.75 (0.62, 0.87)	17.2 (11.6, 23.6)	0.518 (0.238, 1.146)	1.35 (1.10, 1.61)
ochrpy	Ochroma pyramidale	34.6 (28.1, 44.7)	0.90 (0.73, 1.08)	13.4 (6.4, 21.0)	0.702 (0.260, 1.815)	1.39 (1.14, 1.64)
ocotob	Ocotea oblonga	51.4 (43.2, 61.2)	0.75 (0.64, 0.85)	20.5 (14.7, 26.5)	0.562 (0.239, 1.312)	1.31 (1.07, 1.54)
ocotpu	Ocotea puberula	56.5 (47.9, 67.1)	0.75 (0.65, 0.86)	20.9 (14.6, 27.9)	0.584 (0.232, 1.364)	1.37 (1.14, 1.60)
ocotwh	Ocotea whitei	57.4 (49.3, 67.6)	0.78 (0.69, 0.88)	22.0 (16.9, 27.5)	0.717 (0.339, 1.584)	1.24 (1.04, 1.43)
ormocr	Ormosia coccinea	60.0 (51.0, 71.6)	0.77 (0.66, 0.88)	21.3 (15.9, 27.0)	0.391 (0.192, 0.850)	1.33 (1.13, 1.55)
ormoma	Ormosia macrocalyx	58.2 (50.1, 68.2)	0.81 (0.73, 0.91)	28.1 (23.2, 33.5)	0.264 (0.150, 0.467)	1.43 (1.26, 1.61)
ouralu	Ouratea lucens	66.2 (55.9, 79.0)	0.74 (0.67, 0.82)	21.2 (17.6, 25.6)	0.288 (0.147, 0.527)	1.47 (1.24, 1.72)
pochse	Pachira sessilis	58.1 (50.2, 68.3)	0.78 (0.72, 0.84)	20.4 (17.2, 24.4)	0.504 (0.299, 0.861)	1.25 (1.07, 1.41)
perexa	Perebea xanthochyma	59.7 (50.6, 70.9)	0.66 (0.62, 0.71)	19.7 (16.5, 23.4)	0.666 (0.306, 1.493)	1.33 (1.06, 1.58)
picrla	Picramnia latifolia	63.4 (53.2, 76.2)	0.56 (0.48, 0.64)	19.7 (15.7, 24.3)	0.147 (0.070, 0.281)	1.77 (1.54, 2.04)
pipere	Piper reticulatum	56.7 (48.3, 67.3)	0.72 (0.60, 0.84)	22.1 (17.0, 27.8)	0.660 (0.338, 1.342)	1.32 (1.04, 1.56)
pla1pi	Platymiscium pinnatum	65.7 (56.1, 78.3)	0.68 (0.60, 0.75)	18.7 (14.7, 23.3)	0.479 (0.199, 1.174)	1.35 (1.12, 1.56)
pla2el	Platypodium elegans	59.3 (52.0, 68.8)	0.77 (0.70, 0.85)	23.3 (19.9, 27.3)	0.811 (0.353, 1.804)	1.22 (1.04, 1.41)
hybapr	Pombalia prunifolia	61.8 (52.3, 72.8)	0.51 (0.45, 0.58)	22.6 (19.0, 27.0)	0.834 (0.508, 1.365)	1.26 (1.05, 1.47)
poular	Poulsenia armata	57.4 (51.4, 64.8)	0.86 (0.82, 0.91)	33.1 (29.4, 37.4)	0.332 (0.168, 0.636)	1.32 (1.16, 1.50)
pourbi	Pourouma bicolor	51.1 (42.4, 61.2)	0.71 (0.64, 0.78)	16.4 (13.4, 19.8)	0.600 (0.237, 1.520)	1.39 (1.14, 1.65)
poutre	Pouteria reticulata	63.3 (54.5, 75.0)	0.71 (0.66, 0.75)	20.6 (17.5, 24.5)	0.690 (0.400, 1.225)	1.32 (1.16, 1.47)
pri2co	Prioria copaifera	60.1 (55.4, 65.7)	0.86 (0.83, 0.89)	36.5 (33.9, 39.5)	0.908 (0.787, 1.050)	1.18 (1.14, 1.22)
protsp	Protium confusum	54.5 (45.5, 64.7)	0.68 (0.62, 0.75)	16.7 (13.7, 20.2)	0.760 (0.482, 1.179)	1.25 (1.05, 1.44)
protco	Protium costaricense	60.8 (51.0, 72.9)	0.61 (0.54, 0.69)	19.3 (15.2, 23.9)	0.661 (0.328, 1.308)	1.38 (1.14, 1.61)
protpa	Protium panamense	61.8 (52.2, 73.8)	0.68 (0.65, 0.72)	19.8 (16.7, 23.7)	0.356 (0.201, 0.636)	1.42 (1.22, 1.62)
protte	Protium tenuifolium subsp. sessiliflorum	50.1 (40.8, 59.7)	0.75 (0.71, 0.81)	21.2 (17.5, 25.2)	0.565 (0.436, 0.743)	1.37 (1.26, 1.47)
pse1se	Pseudobombax septenatum	52.7 (45.6, 62.2)	0.80 (0.70, 0.90)	20.6 (14.6, 26.9)	0.550 (0.240, 1.351)	1.28 (1.06, 1.48)
psycma	Psychotria marginata	56.9 (48.5, 66.6)	0.68 (0.55, 0.81)	26.1 (21.5, 31.0)	0.552 (0.347, 0.868)	1.36 (1.17, 1.56)
pterro	Pterocarpus hayesii	62.8 (53.9, 73.8)	0.75 (0.69, 0.81)	23.3 (19.8, 27.6)	0.534 (0.289, 1.044)	1.37 (1.17, 1.55)
quaras	Quararibea asterolepis	57.8 (52.1, 64.6)	0.86 (0.82, 0.89)	32.0 (29.1, 35.5)	1.052 (0.884, 1.253)	1.09 (1.03, 1.14)
quasam	Quassia amara	63.9 (53.9, 76.2)	0.56 (0.50, 0.62)	21.5 (17.8, 26.0)	0.591 (0.280, 1.264)	1.34 (1.07, 1.60)
randar	Randia armata	61.3 (51.8, 72.9)	0.52 (0.45, 0.60)	20.6 (16.3, 25.4)	0.771 (0.351, 1.651)	1.35 (1.11, 1.59)
rinosy	Rinorea sylvatica	61.2 (52.3, 71.6)	0.64 (0.59, 0.69)	24.9 (21.1, 29.4)	1.095 (0.593, 2.023)	1.27 (1.03, 1.50)
sapiau	Sapium glandulosum	57.1 (49.2, 67.2)	0.80 (0.71, 0.90)	22.2 (16.6, 28.3)	0.489 (0.206, 1.084)	1.40 (1.19, 1.63)
simaam	Simarouba amara	39.9 (35.8, 44.8)	1.01 (0.97, 1.06)	21.9 (19.7, 24.6)	0.538 (0.458, 0.631)	1.32 (1.25, 1.40)
sipacr	Siparuna cristata	58.6 (49.3, 69.6)	0.76 (0.64, 0.89)	21.7 (16.7, 27.3)	0.680 (0.358, 1.274)	1.30 (1.06, 1.55)
sloate	Sloanea terniflora	55.7 (49.4, 62.8)	0.92 (0.87, 0.97)	33.0 (29.4, 37.0)	0.546 (0.429, 0.690)	1.35 (1.27, 1.43)
soroaf	Sorocea affinis	61.6 (52.1, 72.8)	0.61 (0.57, 0.65)	21.5 (17.9, 25.6)	0.356 (0.210, 0.611)	1.37 (1.16, 1.58)
sponmo	Spondias mombin	50.1 (42.4, 59.7)	0.78 (0.68, 0.89)	20.0 (14.2, 26.3)	0.526 (0.223, 1.248)	1.42 (1.21, 1.63)
sponra	Spondias radlkoferi	54.2 (47.1, 62.2)	0.80 (0.76, 0.85)	28.3 (24.5, 32.3)	0.238 (0.179, 0.314)	1.54 (1.44, 1.65)
sterap	Sterculia apetala	59.3 (52.3, 67.5)	0.82 (0.76, 0.89)	26.9 (23.2, 31.2)	0.487 (0.247, 0.966)	1.39 (1.23, 1.57)

Table S2. *(continued).*

		Tree height (generalized Michaelis-Menten, Eq. 3)			***Crown area (power function, Eq. 2)***	
Mnemonic	**Species**	**a**	**b**	**k**	**a**	**b**
swars2	Swartzia simplex var. continentalis	64.6 (54.4, 76.7)	0.60 (0.56, 0.64)	22.1 (18.5, 26.5)	0.378 (0.216, 0.637)	1.55 (1.37, 1.75)
swars1	Swartzia simplex var. grandiflora	64.9 (54.6, 78.0)	0.56 (0.50, 0.62)	18.6 (15.0, 23.0)	0.482 (0.254, 0.870)	1.48 (1.30, 1.69)
sympgl	Symphonia globulifera	58.6 (49.8, 69.9)	0.78 (0.67, 0.88)	20.5 (14.1, 27.0)	0.546 (0.227, 1.295)	1.36 (1.13, 1.61)
tab1ro	Tabebuia rosea	58.9 (52.3, 66.5)	0.92 (0.86, 0.98)	28.8 (25.5, 32.6)	0.384 (0.289, 0.506)	1.42 (1.33, 1.51)
tab2ar	Tabernaemontana arborea	62.0 (53.5, 73.3)	0.66 (0.61, 0.71)	23.4 (19.5, 27.8)	0.552 (0.298, 1.013)	1.29 (1.13, 1.45)
tachve	Tachigali panamensis	49.7 (44.1, 55.8)	0.97 (0.92, 1.03)	28.9 (26.0, 32.2)	0.647 (0.540, 0.778)	1.43 (1.36, 1.49)
talipr	Talisia croatii	63.0 (53.1, 75.3)	0.73 (0.61, 0.85)	23.8 (18.1, 30.1)	0.131 (0.064, 0.260)	1.48 (1.23, 1.75)
taline	Talisia nervosa	65.2 (54.7, 77.4)	0.60 (0.55, 0.66)	23.5 (19.4, 28.1)	0.216 (0.103, 0.436)	1.48 (1.23, 1.75)
termam	Terminalia amazonia	58.7 (50.5, 69.3)	0.77 (0.66, 0.88)	19.4 (13.7, 25.8)	0.556 (0.232, 1.316)	1.44 (1.21, 1.66)
termob	Terminalia oblonga	59.9 (52.2, 69.7)	0.85 (0.77, 0.93)	25.0 (20.6, 30.0)	0.624 (0.281, 1.390)	1.43 (1.23, 1.63)
tet2pa	Tetragastris panamensis	57.0 (50.0, 65.2)	0.72 (0.70, 0.75)	19.9 (17.5, 22.8)	0.467 (0.397, 0.556)	1.46 (1.40, 1.52)
tocopi	Tocoyena pittieri	53.3 (45.0, 63.7)	0.73 (0.63, 0.83)	22.4 (17.2, 28.1)	0.678 (0.339, 1.314)	1.32 (1.12, 1.53)
tratas	Trattinnickia aspera	50.4 (42.7, 60.5)	0.74 (0.64, 0.84)	14.9 (11.7, 18.6)	0.537 (0.221, 1.255)	1.36 (1.13, 1.58)
tremmi	Trema micrantha	38.6 (31.0, 49.0)	0.88 (0.72, 1.04)	15.0 (8.4, 22.4)	0.605 (0.241, 1.403)	1.42 (1.20, 1.66)
tri2pa	Trichilia pallida	57.1 (48.3, 68.0)	0.68 (0.58, 0.78)	23.3 (17.5, 29.3)	0.598 (0.266, 1.327)	1.35 (1.10, 1.60)
tri2tu	Trichilia tuberculata	57.9 (51.0, 65.7)	0.83 (0.80, 0.85)	27.7 (24.4, 31.5)	0.847 (0.728, 0.988)	1.19 (1.13, 1.24)
tripcu	Triplaris cumingiana	59.0 (50.4, 70.4)	0.79 (0.68, 0.90)	19.8 (13.4, 26.4)	0.474 (0.204, 1.150)	1.27 (1.01, 1.50)
turpoc	Turpinia occidentalis	48.5 (40.3, 57.8)	0.72 (0.62, 0.81)	22.5 (17.0, 28.5)	0.561 (0.232, 1.448)	1.20 (0.94, 1.43)
unonpi	Unonopsis pittieri	58.5 (49.5, 69.7)	0.76 (0.66, 0.87)	21.3 (15.4, 27.7)	0.428 (0.194, 1.007)	1.30 (1.03, 1.55)
virosp	Virola multiflora	55.3 (47.4, 64.7)	0.78 (0.72, 0.84)	20.2 (17.1, 23.8)	0.489 (0.217, 1.306)	1.31 (1.06, 1.53)
virosu	Virola nobilis	65.0 (57.2, 75.4)	0.76 (0.71, 0.81)	24.1 (20.9, 27.8)	0.477 (0.231, 1.056)	1.35 (1.15, 1.52)
virose	Virola sebifera	57.9 (49.7, 67.4)	0.79 (0.75, 0.84)	24.4 (21.0, 28.2)	0.871 (0.499, 1.553)	1.19 (1.01, 1.36)
vochfe	Vochysia ferruginea	50.0 (41.8, 59.8)	0.78 (0.66, 0.90)	18.4 (13.1, 24.4)	0.470 (0.210, 1.030)	1.42 (1.18, 1.67)
xyl1ma	Xylopia macrantha	54.0 (46.0, 63.9)	0.76 (0.72, 0.79)	19.1 (16.1, 22.6)	0.992 (0.537, 1.908)	1.24 (1.02, 1.45)
zantbe	Zanthoxylum ekmanii	44.1 (38.3, 52.4)	0.89 (0.77, 1.01)	16.8 (13.1, 21.0)	0.442 (0.200, 0.950)	1.41 (1.21, 1.62)
zantp1	Zanthoxylum panamense	60.1 (50.9, 71.5)	0.77 (0.67, 0.88)	20.1 (14.1, 26.7)	0.496 (0.206, 1.111)	1.43 (1.21, 1.67)

Table S3. Posterior estimates of the parameters of the hierarchical models for tree height allometry. Table entries correspond to the mean and 90% posterior central intervals for the community level parameters of each allometric function (see Eq. 5 in Methods).

Posterior parameter estimates for tree height models

Functional form	Covariate		α (Mean)	β (Slope)	σ (Variation)
gMM	Growth	a	57.05 (54.48, 59.97)	-0.09332 (-0.133, -0.04791)	0.1075 (0.08175, 0.1373)
		b	0.7348 (0.7176, 0.7524)	0.0374 (0.01427, 0.06038)	0.09253 (0.08194, 0.105)
		k	21.77 (20.7, 22.89)	-1.801 (-2.812, -0.7942)	4.176 (3.637, 4.801)
gMM	Wood density	a	57.08 (54.65, 59.91)	0.03953 (-0.002625, 0.08066)	0.09861 (0.07084, 0.1275)
		b	0.7321 (0.7153, 0.7487)	-0.02491 (-0.04179, -0.007441)	0.09084 (0.08043, 0.1031)
		k	21.75 (20.74, 22.86)	-0.1737 (-1.14, 0.8306)	4.123 (3.604, 4.746)
gMM	Mortality	a	57.24 (54.65, 60.29)	-0.0717 (-0.1192, -0.02381)	0.09581 (0.06977, 0.1238)
		b	0.7323 (0.715, 0.7495)	0.02643 (0.007359, 0.04402)	0.09153 (0.08104, 0.1033)
		k	21.81 (20.7, 23.01)	-0.9538 (-2.126, 0.1576)	4.14 (3.631, 4.74)
gMM	None	a	57.17 (54.69, 59.87)		0.1012 (0.07492, 0.1295)
		b	0.7278 (0.7113, 0.7456)		0.0929 (0.08251, 0.1057)
		k	21.57 (20.54, 22.66)		4.194 (3.666, 4.822)
Power	Growth	a	3.029 (2.936, 3.125)	0.05567 (0.03785, 0.07331)	0.1021 (0.0905, 0.1154)
		b	0.5576 (0.5465, 0.5687)	-0.03353 (-0.04574, -0.02132)	0.06988 (0.06218, 0.07942)
Power	Wood density	a	2.988 (2.896, 3.082)	-0.0006186 (-0.01776, 0.01625)	0.1117 (0.09968, 0.1257)
		b	0.5609 (0.5501, 0.5723)	0.01287 (0.001632, 0.02434)	0.0707 (0.06283, 0.07958)
Power	Mortality	a	2.994 (2.902, 3.091)	0.01294 (-0.004155, 0.03049)	0.1116 (0.09976, 0.1254)
		b	0.5604 (0.5489, 0.5714)	-0.01608 (-0.02736, -0.004805)	0.07063 (0.06258, 0.08001)
Power	None	a	2.979 (2.888, 3.076)		0.1113 (0.09941, 0.1253)
		b	0.5616 (0.5501, 0.573)		0.07094 (0.06295, 0.08077)
Weibull	Growth	a	40.99 (39.52, 42.56)	-2.06 (-3.15, -0.7914)	4.089 (3.202, 5.097)
		b	0.0675 (0.06473, 0.07056)	0.004051 (0.001157, 0.006867)	0.01169 (0.009993, 0.01369)
		k	0.6995 (0.6844, 0.7145)	0.02407 (0.00513, 0.04369)	0.08835 (0.07873, 0.09955)
Weibull	Wood density	a	40.98 (39.53, 42.52)	0.5059 (-0.7509, 1.743)	3.981 (3.094, 5.009)
		b	0.06717 (0.06442, 0.07025)	0.001369 (-0.001021, 0.003836)	0.01157 (0.009918, 0.01366)
		k	0.6976 (0.6835, 0.7125)	-0.01604 (-0.03077, -0.001495)	0.0871 (0.07755, 0.09825)
Weibull	Mortality	a	41.09 (39.57, 42.68)	-1.287 (-2.798, 0.1783)	3.886 (3.022, 4.896)
		b	0.06712 (0.06412, 0.07019)	0.0008289 (-0.001922, 0.003454)	0.01155 (0.009865, 0.0135)
		k	0.6978 (0.6829, 0.7129)	0.01537 (-0.0008984, 0.03091)	0.08763 (0.07749, 0.09876)
Weibull	None	a	40.99 (39.53, 42.59)		4.081 (3.148, 5.095)
		b	0.06767 (0.06469, 0.07072)		0.01191 (0.01016, 0.01385)
		k	0.6954 (0.6809, 0.7106)		0.08858 (0.07873, 0.1004)

Table S4. Posterior estimates of the parameters of the hierarchical models for crown area allometry. Table entries correspond to the mean and 90% posterior central intervals for the community level parameters of each allometric function (see Eq. 5 in Methods).

Posterior parameter estimates for crown area models

Functional form	Covariate		α (Mean)	β (Slope)	σ (Variation)
gMM	Growth	a	418 (363.4, 473.2)	0.08395 (-0.03009, 0.1973)	0.3042 (0.2406, 0.3647)
		b	1.427 (1.395, 1.461)	0.02819 (-0.007316, 0.06313)	0.09068 (0.07131, 0.1141)
		k	780.3 (694.9, 868.7)	93.05 (11.69, 170.7)	160.6 (33.13, 226.8)
gMM	Wood density	a	423.8 (366.1, 485.5)	-0.02087 (-0.1385, 0.09542)	0.3172 (0.2575, 0.3783)
		b	1.424 (1.391, 1.459)	-0.004723 (-0.03743, 0.03022)	0.0978 (0.07692, 0.1208)
		k	775.9 (690.5, 869.8)	-48.16 (-124.3, 25.78)	141 (41.78, 227.7)
gMM	Mortality	a	411.5 (362, 471.1)	0.05977 (-0.05878, 0.1709)	0.3052 (0.252, 0.3663)
		b	1.428 (1.397, 1.46)	0.03795 (0.005023, 0.06967)	0.09006 (0.0716, 0.1121)
		k	771.8 (688.1, 864.7)	70.19 (3.028, 133.6)	158.4 (87.77, 221.3)
gMM	None	a	423.3 (373.3, 484.4)		0.3114 (0.2512, 0.3757)
		b	1.421 (1.39, 1.456)		0.09434 (0.07534, 0.1175)
		k	768.3 (699.7, 864.6)		164.1 (71.55, 239.1)
Power	Growth	a	0.568 (0.5075, 0.6384)	0.02852 (-0.02939, 0.08544)	0.3065 (0.2644, 0.3537)
		b	1.34 (1.303, 1.374)	0.005619 (-0.03522, 0.04613)	0.1511 (0.1176, 0.1916)
Power	Wood density	a	0.5571 (0.4981, 0.6282)	0.05064 (-0.001368, 0.1046)	0.3033 (0.2598, 0.3533)
		b	1.346 (1.309, 1.38)	0.01092 (-0.02278, 0.04919)	0.1534 (0.1213, 0.1927)
Power	Mortality	a	0.5689 (0.5029, 0.6385)	0.02877 (-0.02567, 0.07852)	0.3096 (0.2662, 0.3556)
		b	1.339 (1.305, 1.375)	0.001199 (-0.03549, 0.03631)	0.1538 (0.1209, 0.1942)
Power	None	a	0.5659 (0.5032, 0.6346)		0.3033 (0.2593, 0.3518)
		b	1.341 (1.306, 1.376)		0.1558 (0.1241, 0.1953)
Weibull	Growth	a	469.1 (408.2, 540)	50.35 (-7.432, 103.7)	114 (73.99, 149.8)
		b	0.0012 (0.001036, 0.001413)	-0.0001886 (-0.0003151, -7.218e-05)	0.0002285 (0.0001421, 0.0003643)
		k	1.397 (1.372, 1.43)	0.0385 (0.008854, 0.0715)	0.0859 (0.06889, 0.1032)
Weibull	Wood density	a	477.1 (406.8, 558.8)	-46.71 (-99.32, 10.12)	124.9 (82.05, 154.6)
		b	0.001211 (0.001036, 0.001415)	0.0002207 (3.596e-05, 0.0003439)	0.0001932 (0.0001311, 0.0003464)
		k	1.395 (1.365, 1.42)	-0.003965 (-0.0363, 0.02225)	0.08728 (0.07315, 0.1057)
Weibull	Mortality	a	466.9 (408, 531.5)	57.68 (12.43, 93.66)	114.3 (87.85, 144.1)
		b	0.001226 (0.001064, 0.001418)	-0.0002813 (-0.0003917, -0.0001416)	0.0002179 (0.0001356, 0.0003161)
		k	1.397 (1.371, 1.424)	0.04507 (0.01622, 0.07342)	0.08366 (0.06676, 0.103)
Weibull	None	a	486.7 (422.1, 559.4)		115.6 (52.38, 158.1)
		b	0.001174 (0.001009, 0.001351)		0.0002555 (6.624e-05, 0.0003783)
		k	1.389 (1.364, 1.416)		0.08765 (0.07073, 0.1066)

Figure S1. Species-specific relationships of tree height with trunk diameter, showing the data (points) and fitted relationships (solid lines) together with their 90% posterior central intervals (dashed lines). The annotations on each plot detail sample size (*n*) and the observed range of tree heights (*H*) for each species. Note the log–log axes (multiple pages).

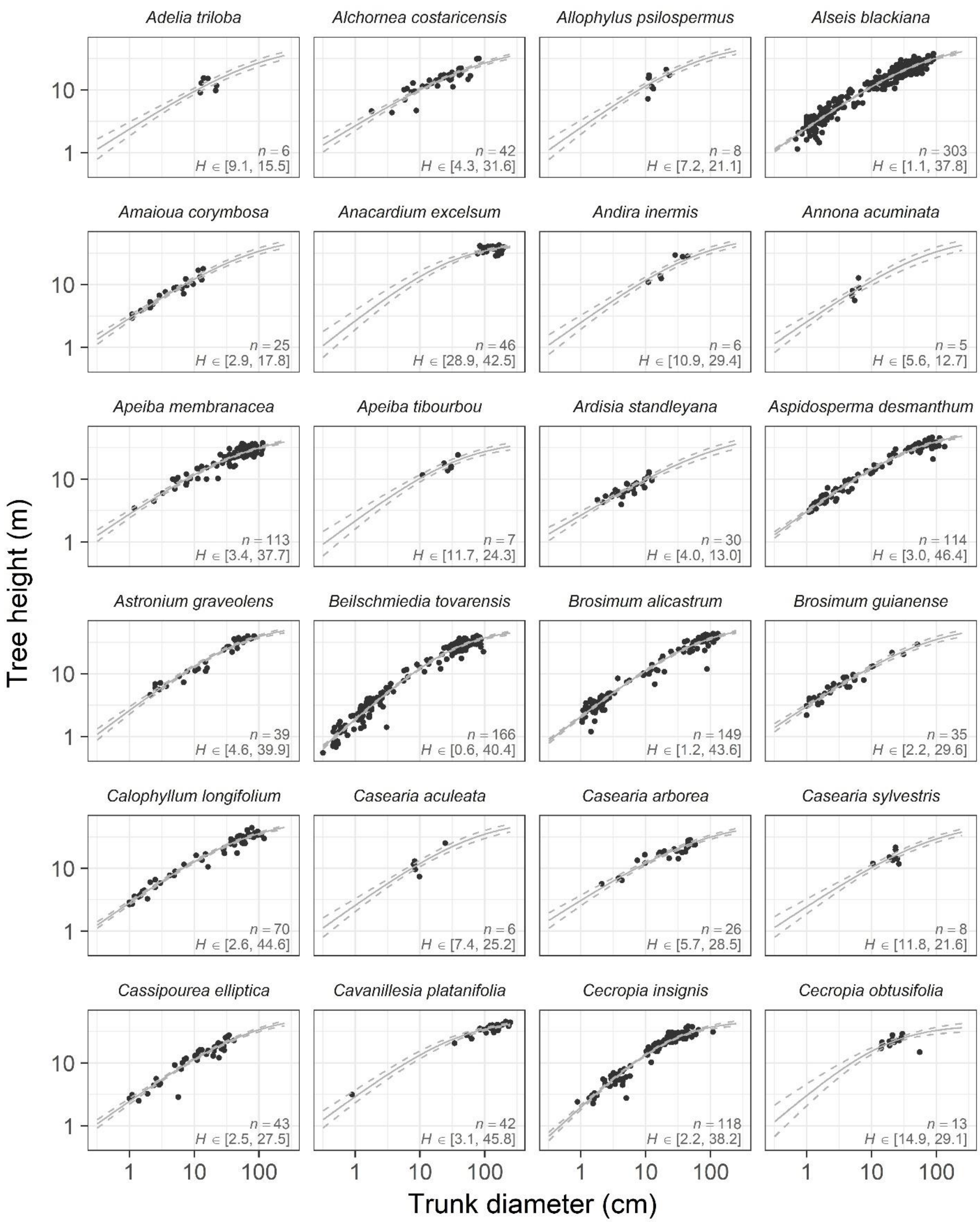


Figure S1. *(continued).*

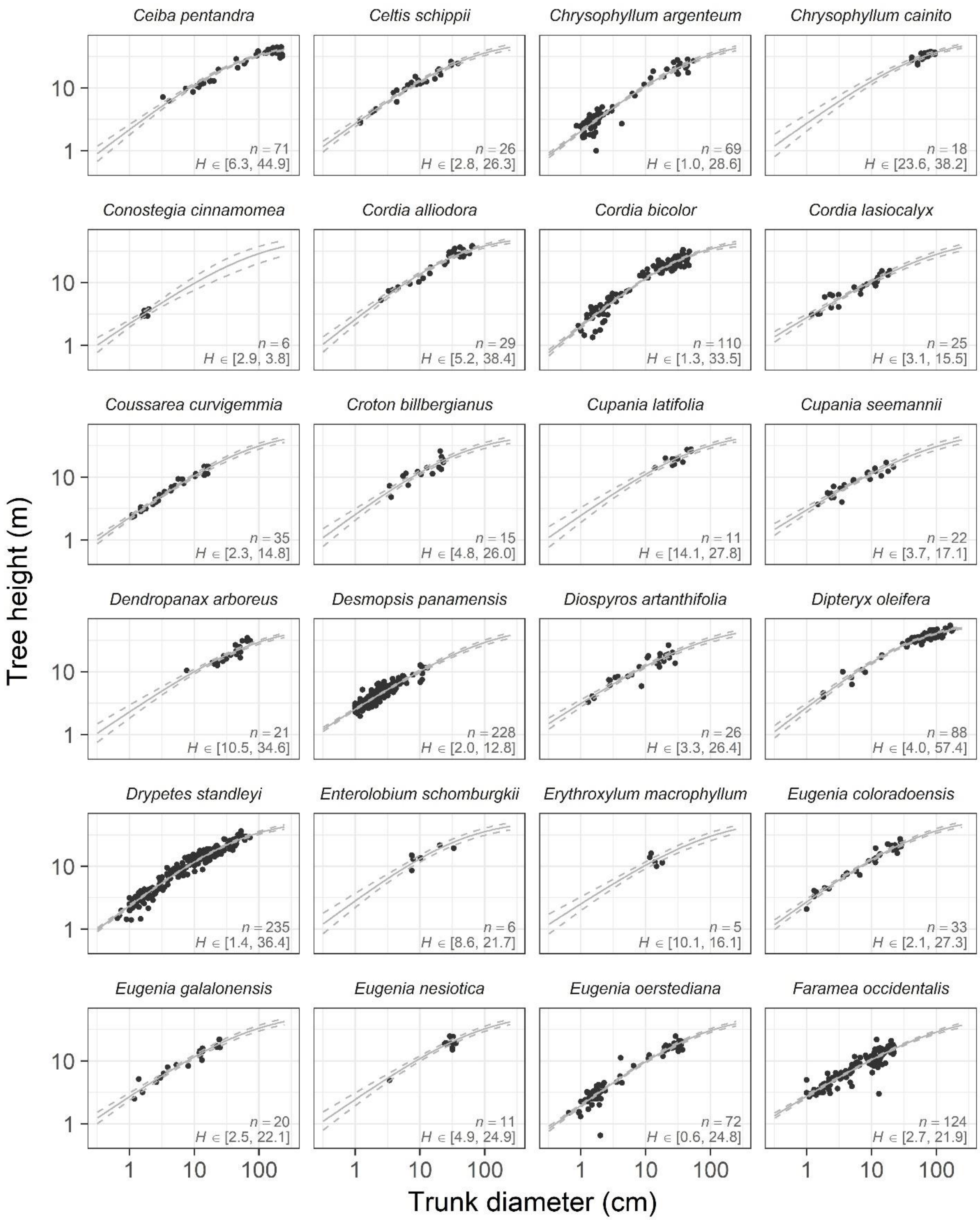


Figure S1. *(continued).*

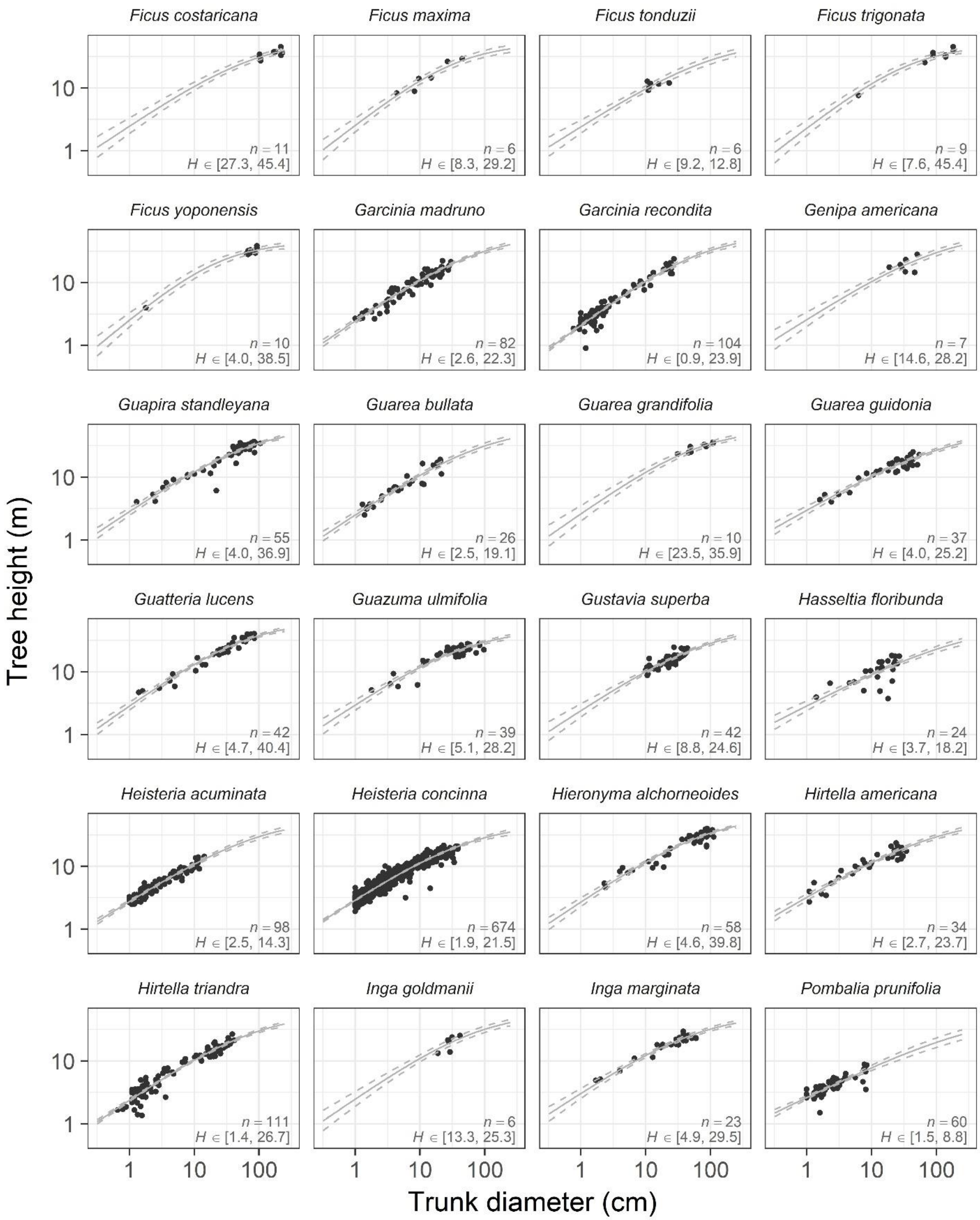


Figure S1. *(continued).*

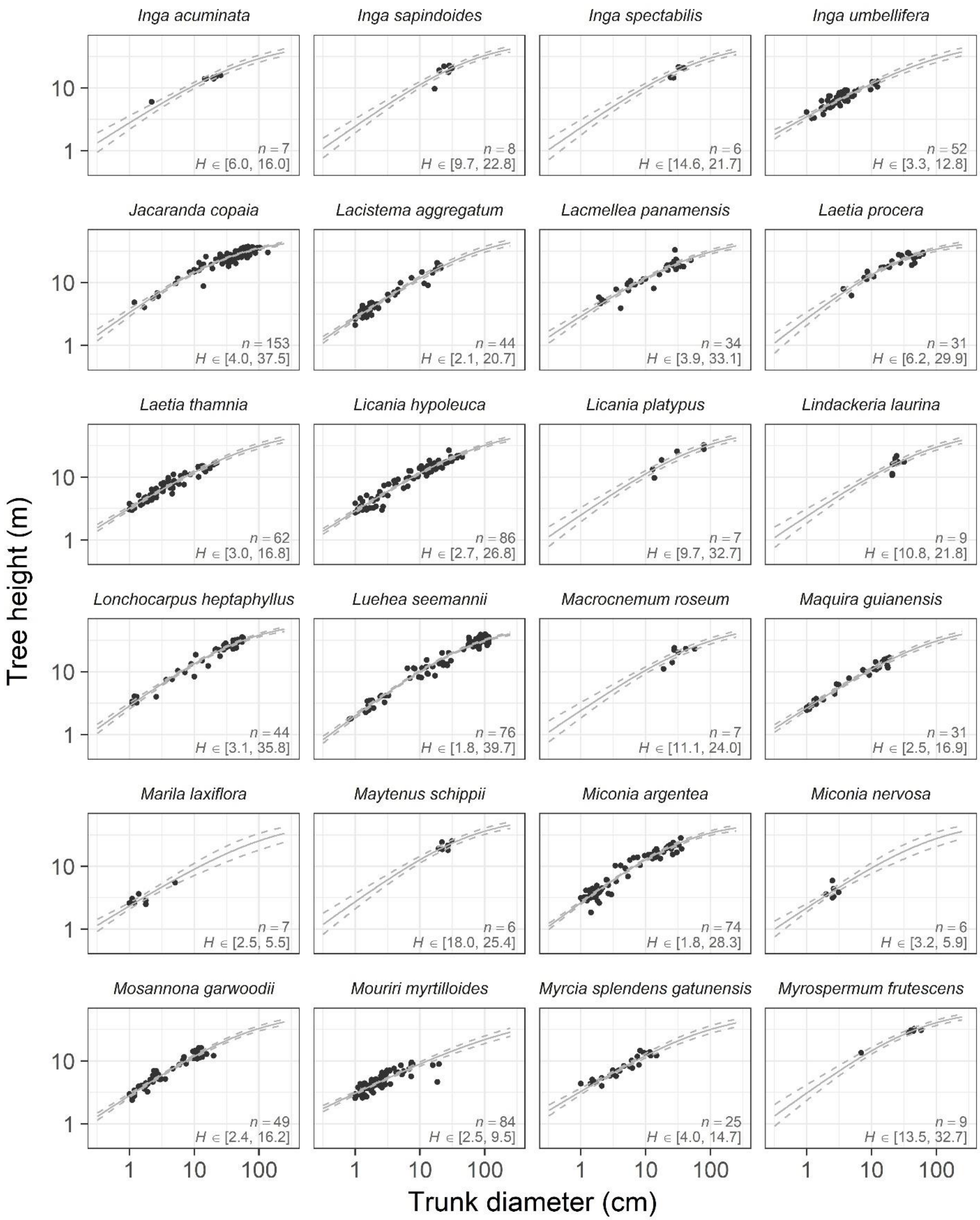


Figure S1. *(continued).*

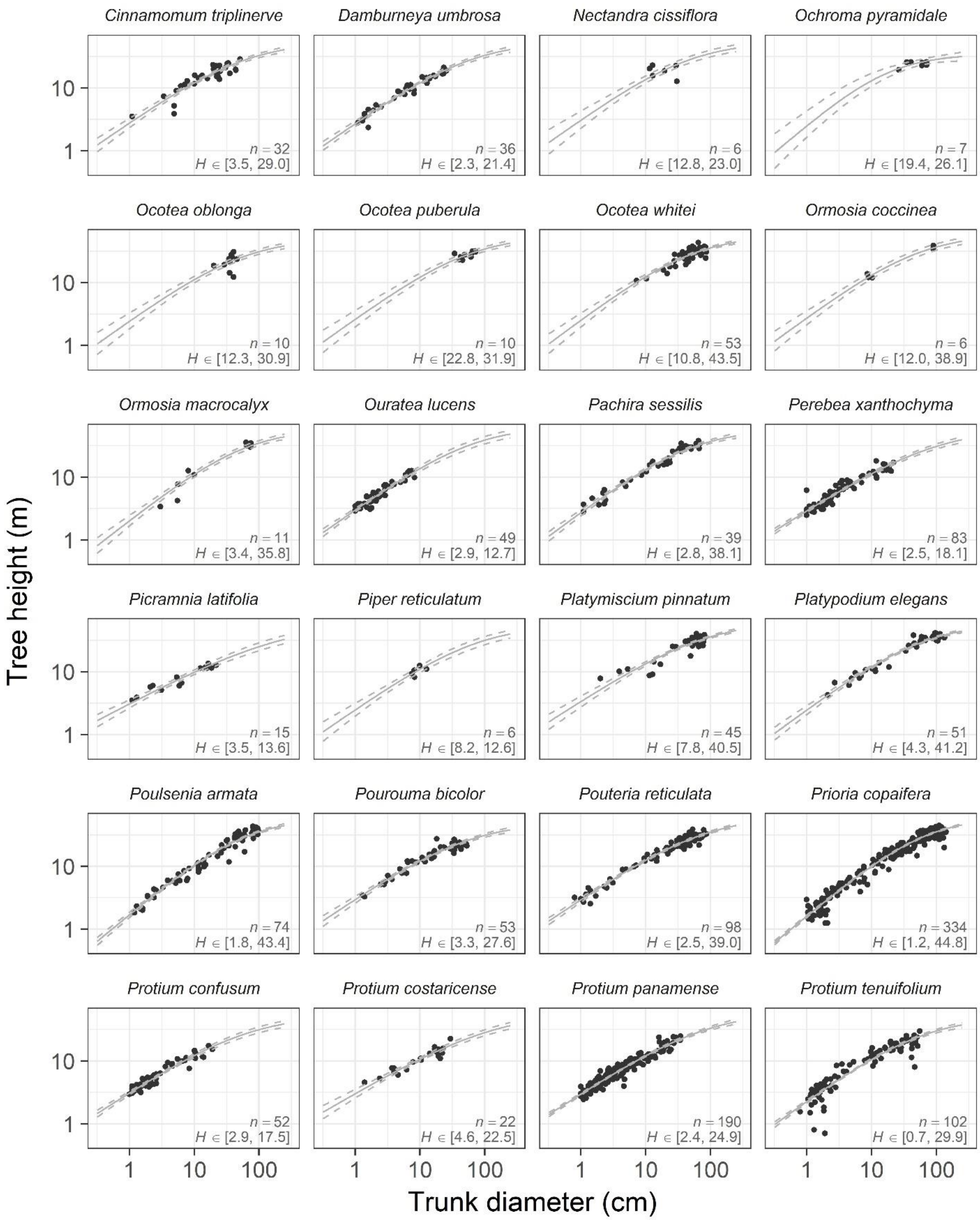


Figure S1. *(continued).*

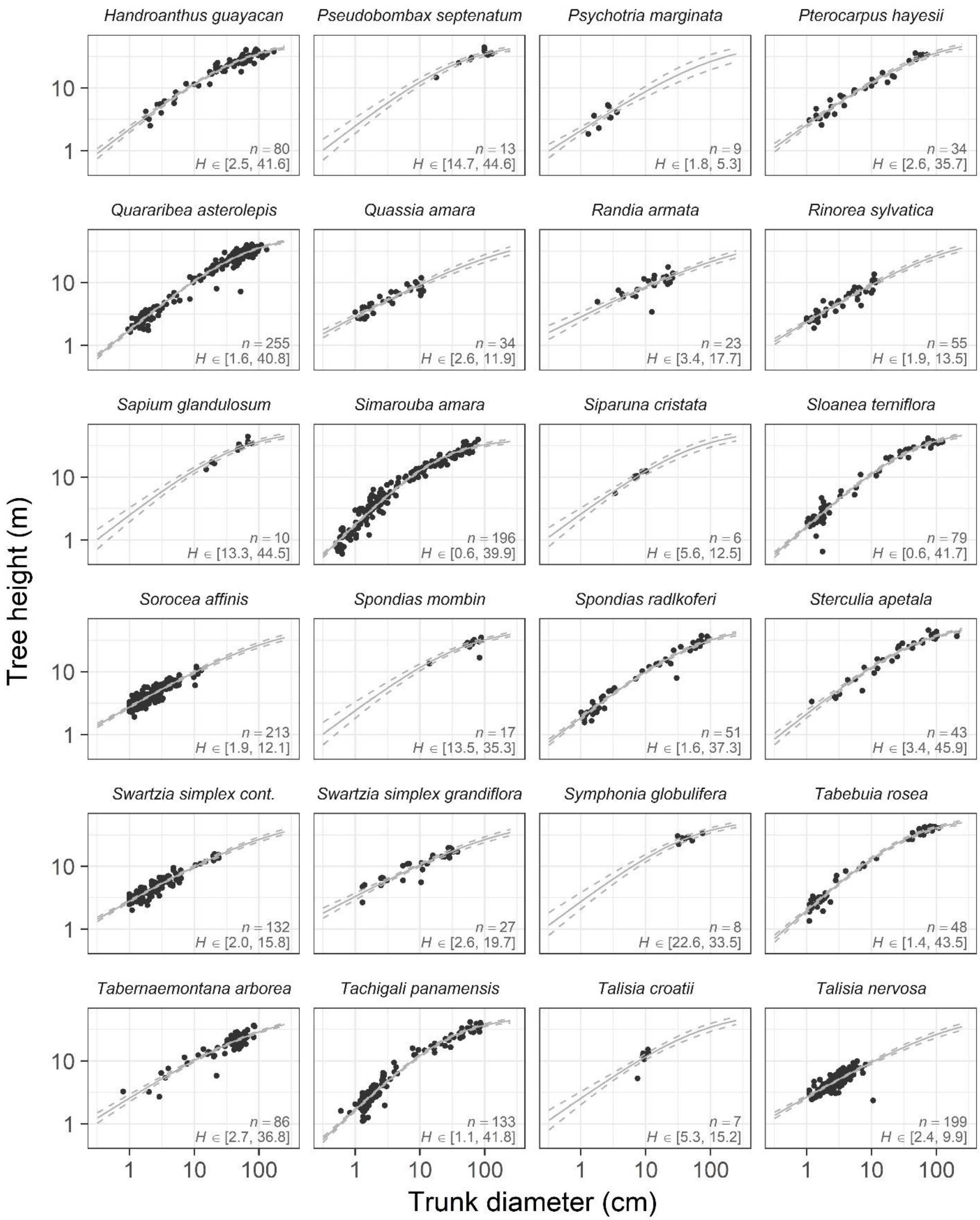


Figure S1. *(continued).*

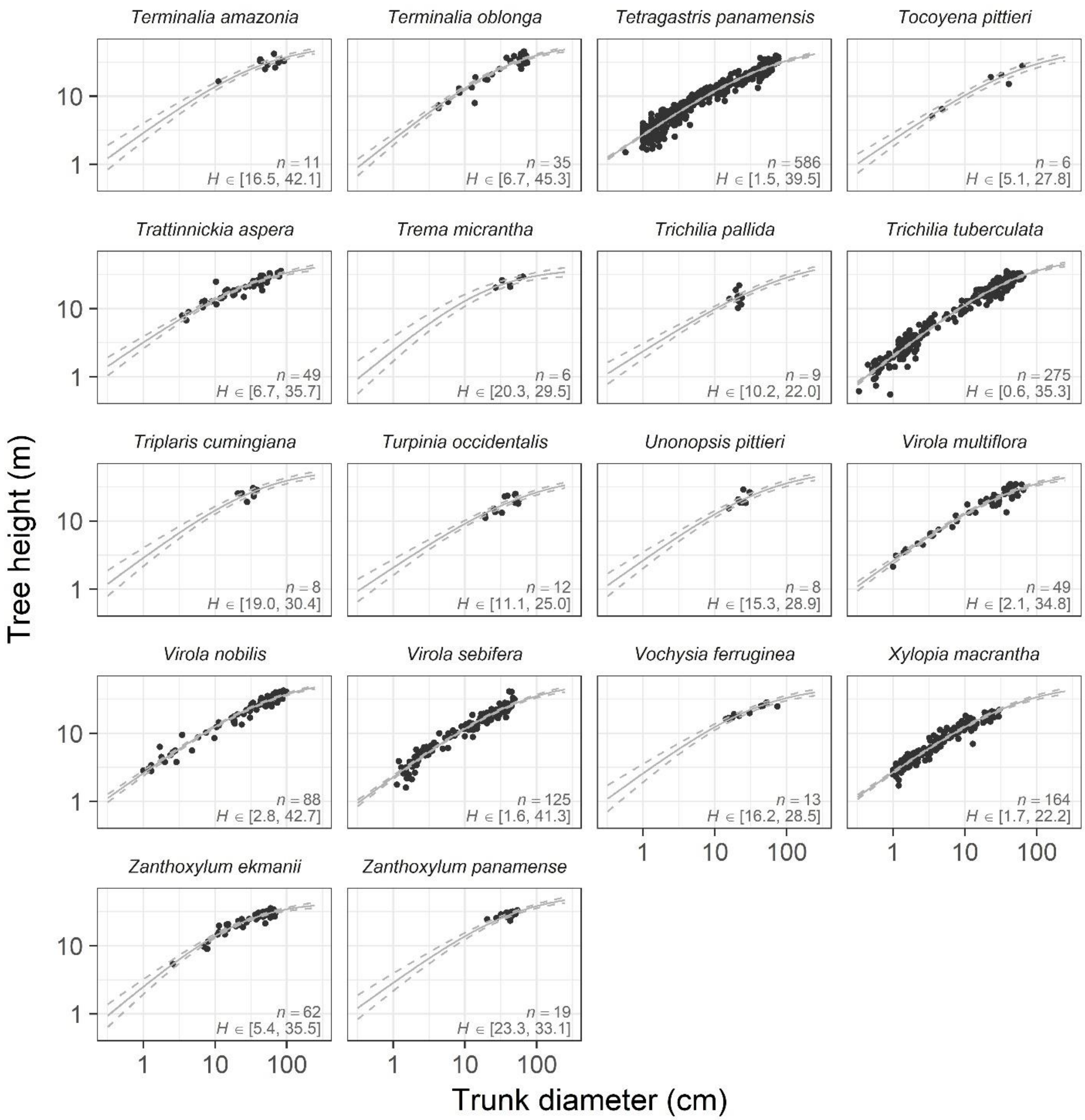


Figure S2. Species-specific relationships of crown area with trunk diameter, showing the data (points) and fitted relationships (solid lines) together with their 90% posterior central intervals (dashed lines). The annotations on each plot detail sample size (*n*) and the observed crown area (*C*) range for each species. Note the log–log axes (multiple pages).

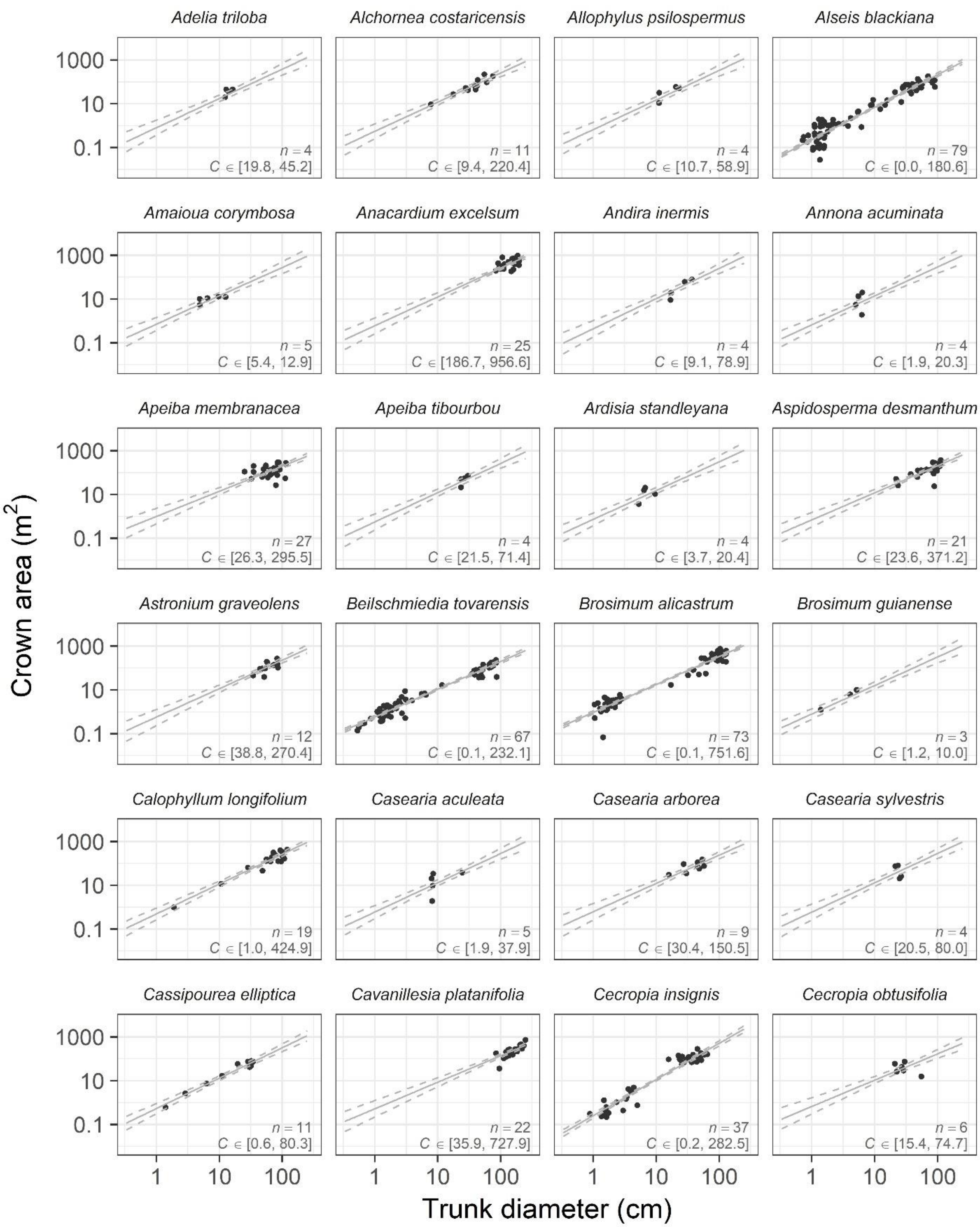


Figure S2. (*continued*).

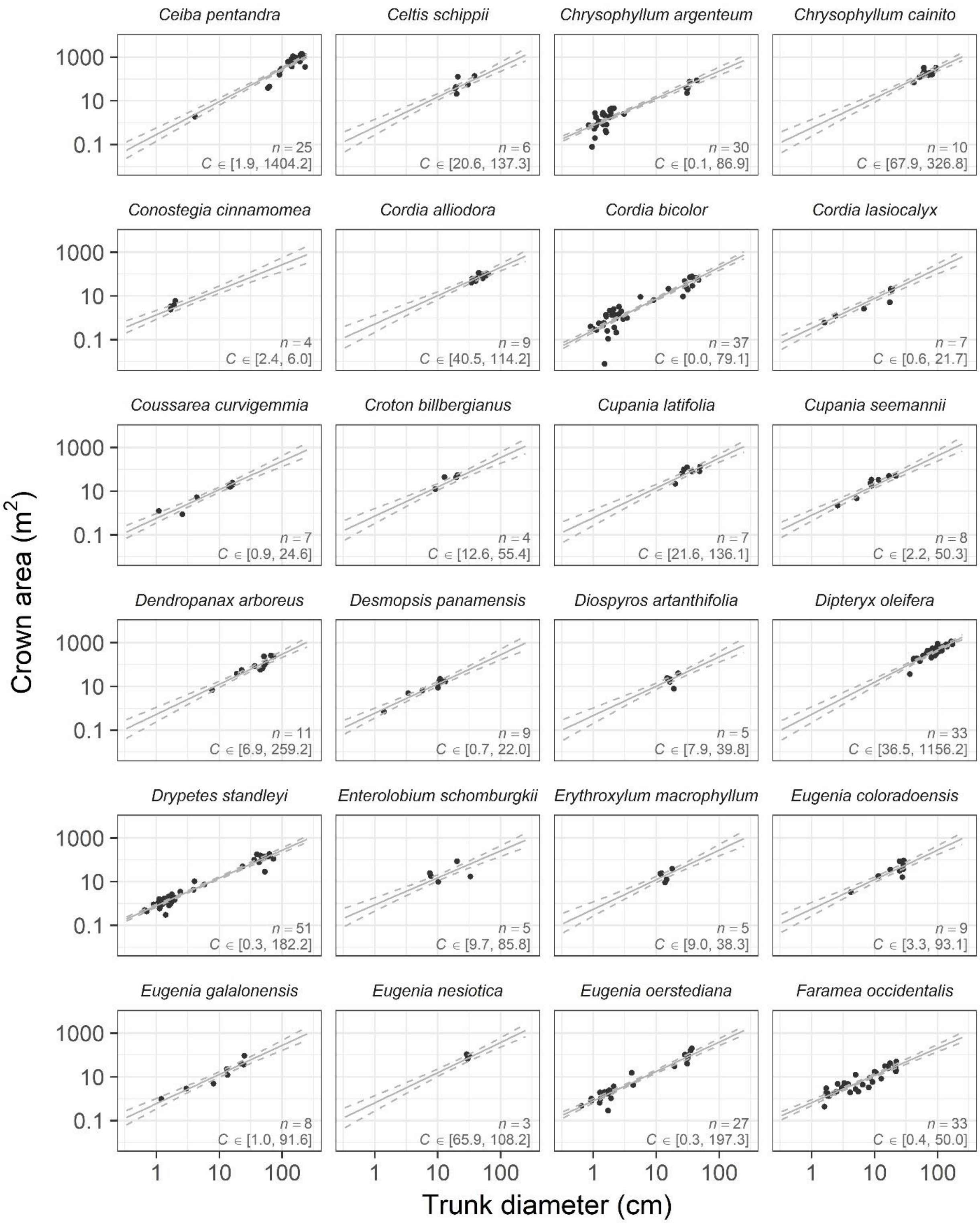


Figure S2. (*continued*).

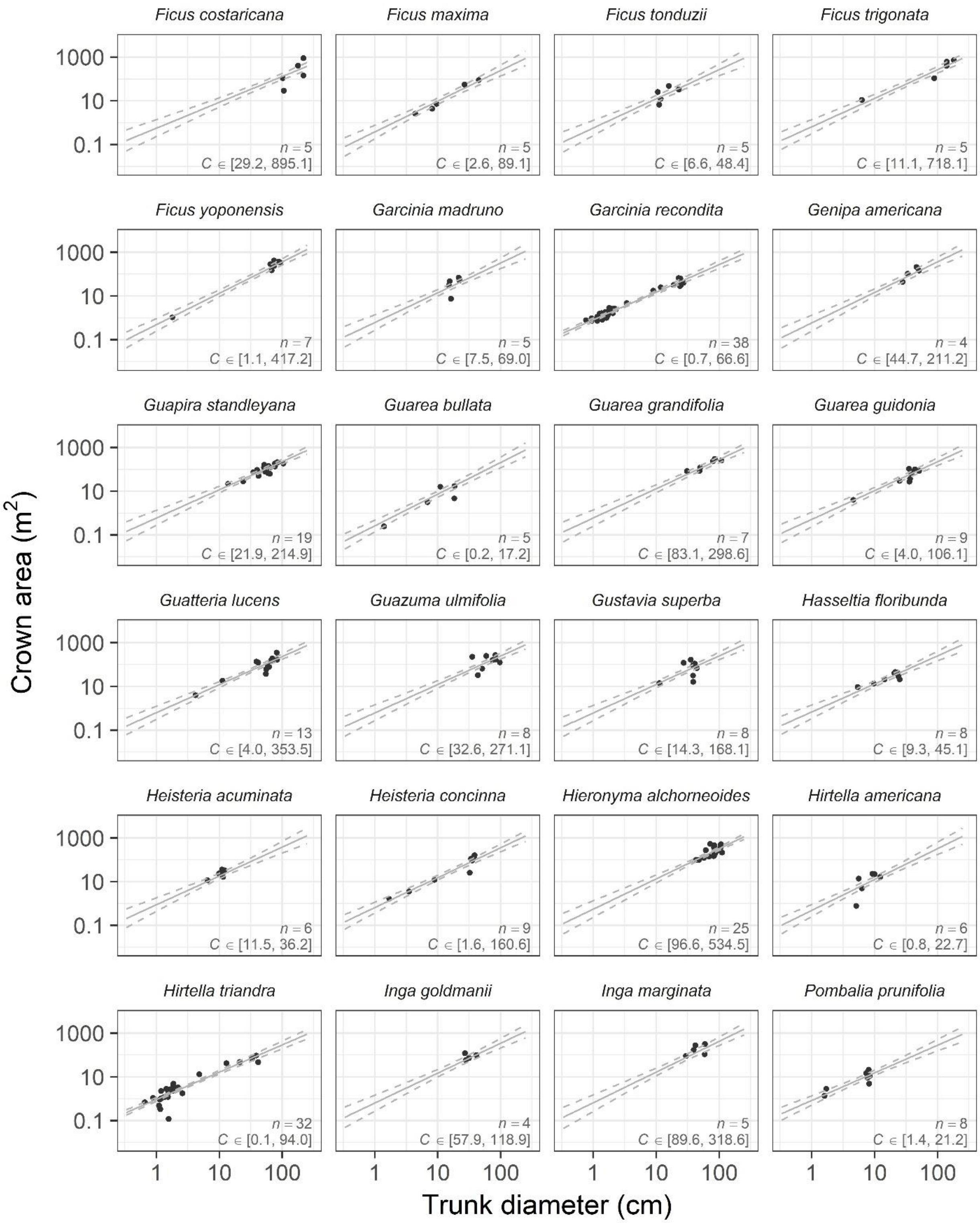


Figure S2. (*continued*).

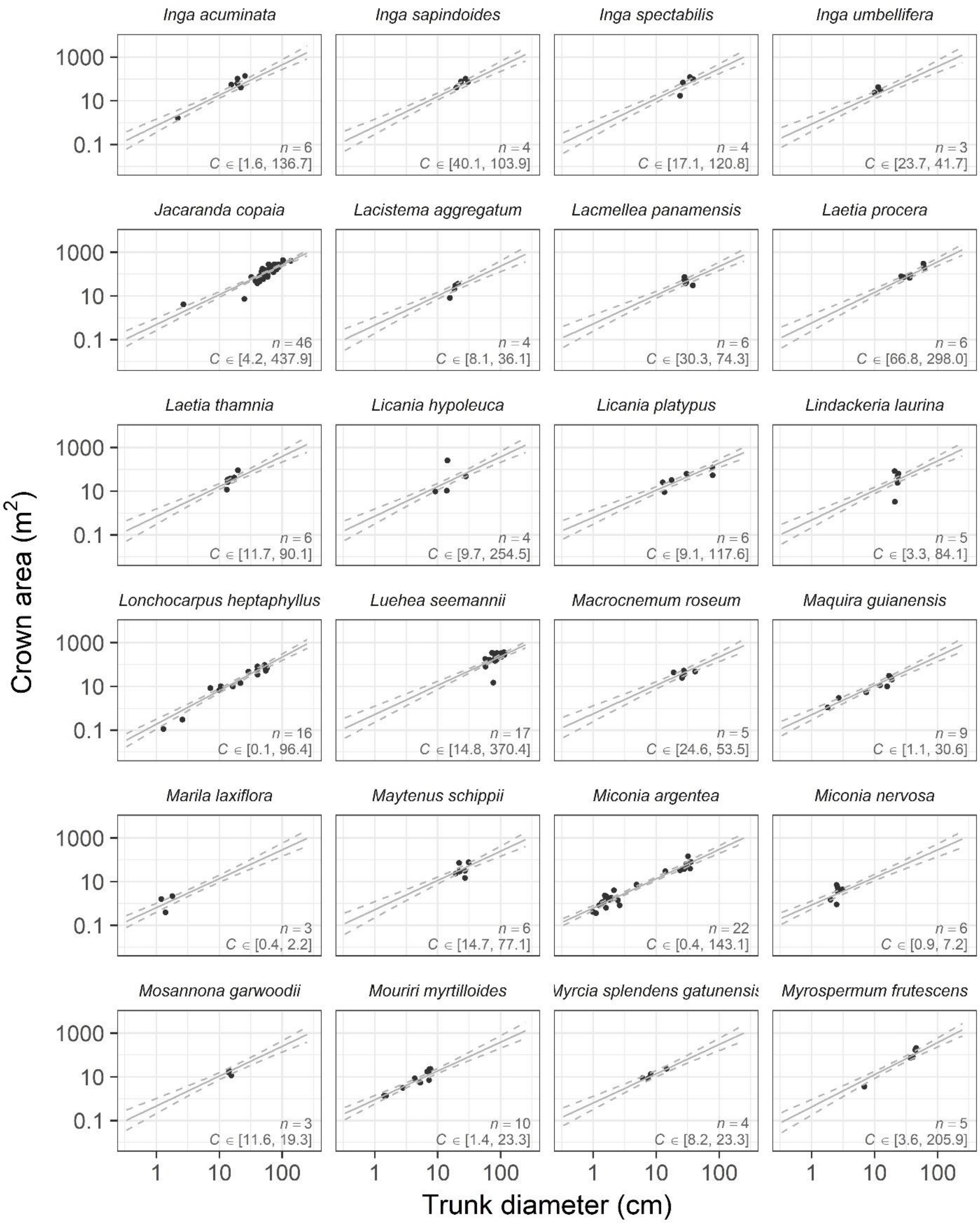


Figure S2. (*continued*).

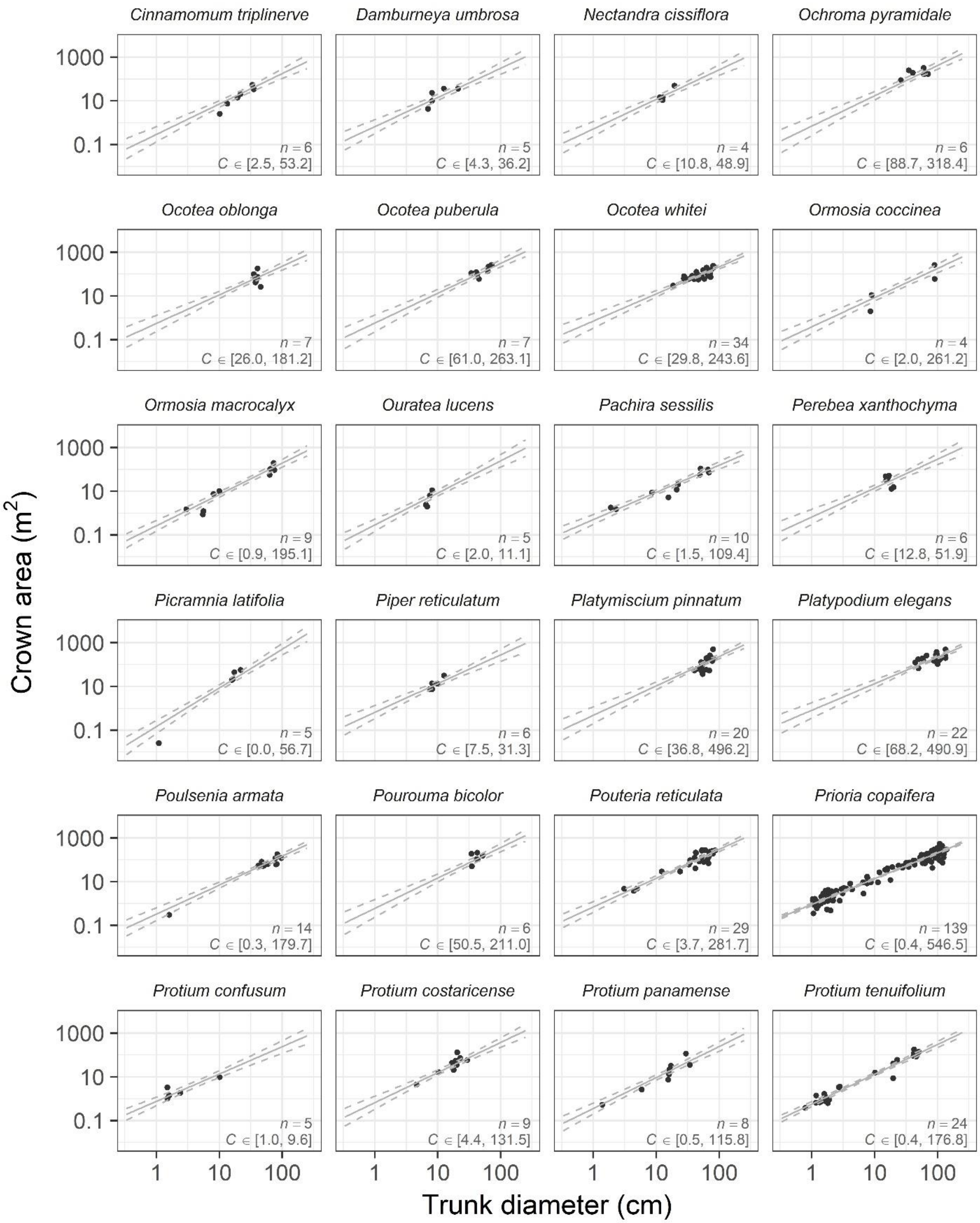


Figure S2. (*continued*).

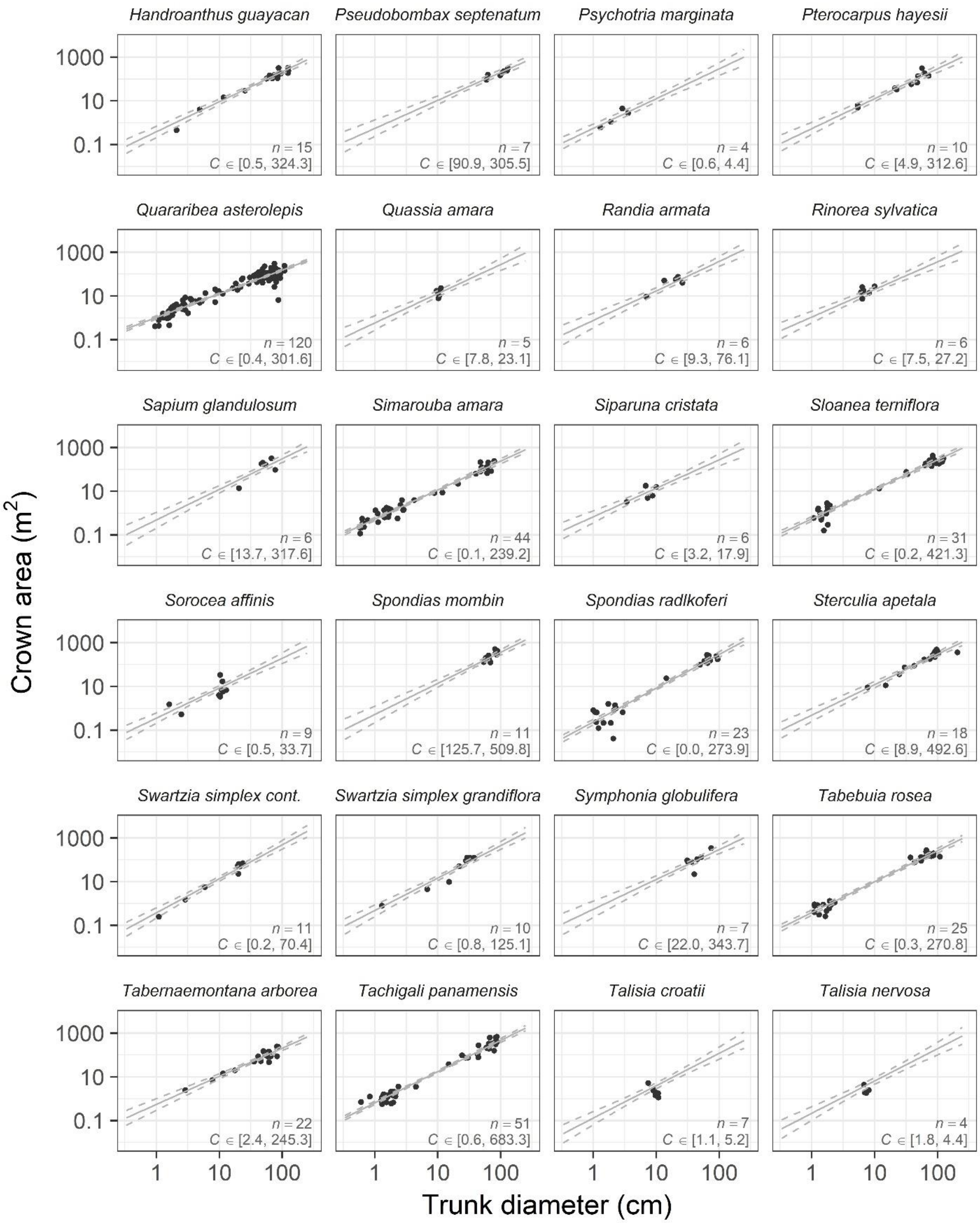


Figure S2. (*continued*).

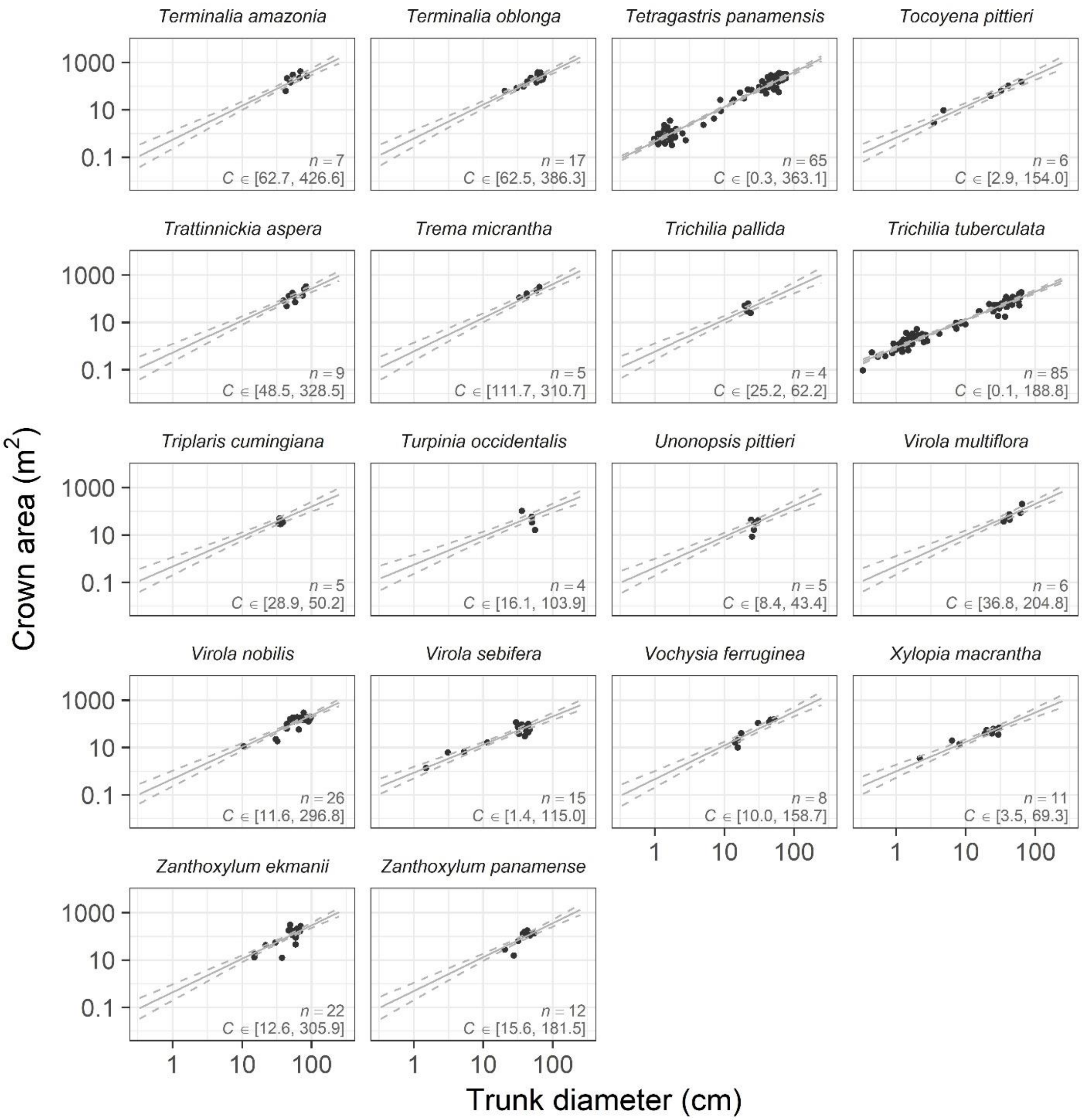
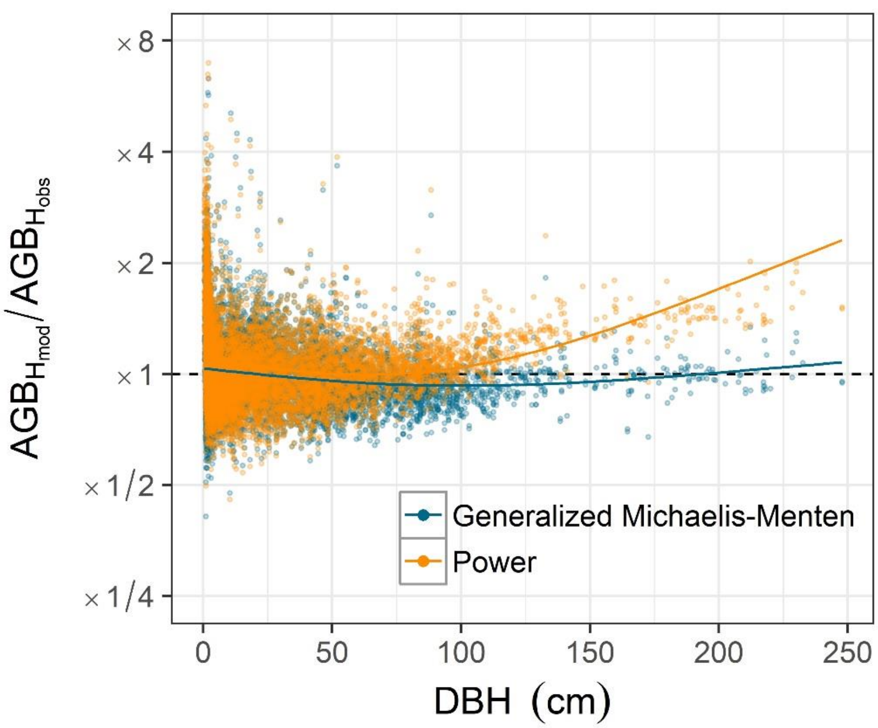


Figure S3. Relative error for estimates of individual tree dry aboveground biomass (*AGB*, Kg dry matter) based on model predictions of tree height (AGB_{Hmod}) compared with estimates derived from height observations (AGB_{Hobs}). This figure shows the entire range of observed DBHs (Fig. 4b in the main text highlighted differences for large trees, i.e. DBH > 30 cm). Modeled tree heights were from community-level models fitted with either the power function (orange dots) or generalized Michaelis-Menten function (blue dots). All *AGB* estimates were based on the biomass allometry equation 6 (from Chave et al. 2014) and used the average value of wood density across species, to highlight variation related to the height allometry. The lines are LOESS smoothers that illustrate the overall departures of each model from perfect prediction (i.e. AGB_{Hmod}/AGB_{Hobs} ratio equal to unity) as a function of DBH.



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Section S2: *Stan code*

Power function model

```
// Linear mixed model with varying parameters among species and one species level covariate
// for a power function allometric model
data {
  // inputs
  int<lower=0> N; // number of individuals
  int<lower=0> Ng; // number of species
  int<lower=0> p; // number of parameters per species  vector[N] y; // dependent variable: natural
logarithm of tree height or crown area
  vector[N] x; // independent variable: natural logarithm of trunk diameter
  int g[N]; // species indicator
  real xbar; // mean of x  vector[Ng] z; // trait covariate, one value per species
  real zbar; real zs; // mean and standard deviation of the covariate z across species
}
transformed data{
  vector[Ng] zc; // centered and scaled covariate
  for ( i in 1:Ng )
  {
      zc[i] = ( z[i] - zbar ) / zs;
  }
}
parameters {
  vector[p] theta[Ng]; // species parameters of the allometric model: here a and b (Eq. 1 in the main
text)
  vector[p] alpha; // community level means (means of parameters across species) (Eq. 5 of the main text)
  vector[p] beta; // community level effects of the covariate 'z' on each parameter (Eq. 5 of the main
text)
  real<lower=0> sigmaa; // standard deviation of parameter a across species,
  real<lower=0> sigmab; // standard deviation of parameter b across species
  real<lower=0> serror; // standard deviation for observation error (sigmav in Eq. 1 of main text)
}
transformed parameters {
  vector[N] y_hat; // predicted mean for each y  for ( n in 1:N )
  {
    // power function
    y_hat[n] = theta[g[n], 1] + theta[g[n], 2] * ( x[n] - xbar );
  }
}
model {
  // prior distributions for the community level means
  alpha[1] ~ normal( 0, 100 ); alpha[2] ~ normal( 0, 100 );
  // prior distributions for community level covariate effects
  beta[1] ~ normal( 0, 100 ); beta[2] ~ normal( 0, 100 );
  // community level parameters act as priors of species level parameters
  for ( i in 1:Ng )
  {
    theta[i, 1] ~ normal( alpha[1] + beta[1] * zc[i], sigmaa ); // prior for species level parameter log a
    theta[i, 2] ~ normal( alpha[2] + beta[2] * zc[i], sigmab ); // prior for species level parameter b
  }
  // data model
  y ~ normal( y_hat, serror );
  // weakly informative priors for scale parameters
  sigmaa ~ cauchy( 0.0, 2.5 ); sigmab ~ cauchy( 0.0, 2.5 );
  serror ~ cauchy( 0.0, 2.5 );
}
generated quantities {
  // pointwise log-likelihoods for WAIC estimation
  vector[N] log_lik;
  for ( n in 1:N )
  {
    log_lik[n] = normal_lpdf( y[n] | y_hat[n], serror );
  }
}
```

Generalized Michaelis-Menten model

```
// Nonlinear mixed model with varying parameters among species and one species level covariate
// for a generalized Michaelis Menten allometric model
data {
  int<lower=0> N; // number of individuals
  int<lower=0> Ng; // number of species
  int<lower=0> p; // number of parameters per species
  vector[N] y; // dependent variable: natural logarithm of tree height or crown area
  vector[N] x; // independent variable: natural logarithm of trunk diameter
  int g[N]; // species indicator
  real xbar; // mean of x
  vector[Ng] z; // trait covariate, one value per species
  real zbar; real zs; // mean and standard deviation of the covariate z across species
}
transformed data{
  vector[Ng] zc; // centered and scaled covariate
  for ( i in 1 : Ng )
  {
      zc[i] = ( z[i] - zbar ) / zs;
  }
}
parameters {
  vector[p] theta[Ng]; // species parameters of the allometric model: here a, b and k (Eq. 1 in the main
text)
  vector[p] alpha; // community level means (means of parameters across species) (Eq. 5 of the main text)
  vector[p] beta; // community level effects of the covariate 'z' on each parameter (Eq. 5 of the main
text)
  real< lower=0 > sigmaa; // standard deviation of parameter a across species,
  real< lower=0 > sigmab; // standard deviation of parameter b across species,
  real< lower=0 > sigmak; // standard deviation of parameter k across species
  real< lower=0 > serror; // standard deviation for observation error (sigmav in Eq. 1 of main text)
}
transformed parameters {
  vector[N] y_hat; // predicted mean for each y
  for ( n in 1 : N )
  {
    // generalized Michaelis Menten
    y_hat[n] = theta[g[n], 1] + theta[g[n], 2] * log( x[n] ) - log(theta[g[n], 3] + pow( x[n], theta[g[n],
2] ) );
  }
}
model {
  // prior distributions for the community level means
  alpha[1] ~ normal( 0, 100 ); alpha[2] ~ normal( 0, 100 )T[0,]; alpha[3] ~ normal( 0, 100 )T[0,];
  // prior distribution for community level covariate effects
  beta[1] ~ normal( 0, 100 ); beta[2] ~ normal( 0, 100 ); beta[3] ~ normal( 0, 100 );
    // community level parameters act as priors of species level parameters
  for ( i in 1 : Ng )
  {
    theta[i, 1] ~ normal( mu[1] + theta[1] * zc[i], sigmaa ); // prior for species level parameter log a
    theta[i, 2] ~ normal( mu[2] + theta[2] * zc[i], sigmab )T[0,]; // prior for species level parameter b
    theta[i, 3] ~ normal( mu[3] + theta[3] * zc[i], sigmak )T[0,]; // prior for species level parameter k
  }
  // data model
  y ~ normal( y_hat, serror );
  // weakly informative priors for scale parameters
  sigmaa ~ cauchy( 0.0, 2.5 ); sigmab ~ cauchy( 0.0, 2.5 ); sigmak ~ cauchy( 0.0, 2.5 );
  serror ~ cauchy( 0.0, 2.5 );
}
generated quantities {
  // pointwise log-likelihoods for WAIC estimation
  vector[N] log_lik;
  for ( n in 1 : N )
  {
    log_lik[n] = normal_lpdf( y[n] | y_hat[n], serror );
  }
}
```

Rescaled Weibull model

```
// Nonlinear mixed model with varying parameters among species and one species level covariate
// for a rescaled Weibull allometric model
data {
  int<lower=0> N; // number of individuals
  int<lower=0> Ng; // number of species
  int<lower=0> p; // number of parameters per species  vector[N] y; // dependent variable: natural
logarithm of tree height or crown area
  vector[N] x; // independent variable: natural logarithm of trunk diameter
  int g[N]; // species indicator
  real xbar; // mean of x  vector[Ng] z; // trait covariate, one value per species
  real zbar; real zs; // mean and standard deviation of the covariate z across species
}
transformed data{
  vector[Ng] zc; // centered and scaled covariate
  for ( i in 1 : Ng )
  {
      zc[i] = ( z[i] - zbar ) / zs;
  }
}
parameters {
  vector[p] theta[Ng]; // species parameters of the allometric model: here a, b and k (Eq. 1 in the main
text)
  vector<lower=0>[p] alpha; // community level means (means of parameters across species) (Eq. 5 of the
main text)
  vector[p] beta; // community level effects of the covariate 'z' on each parameter (Eq. 5 of the main
text)
  real<lower=0> sigmaa; // standard deviation of parameter a across species,
  real<lower=0> sigmab; // standard deviation of parameter b across species,
  real<lower=0> sigmak; // standard deviation of parameter k across species
  real<lower=0> serror; // standard deviation for observation error (sigmav in Eq. 1 of main text)
}
transformed parameters {
  vector[N] y_hat; // predicted mean for each y  for ( n in 1 : N )
  {
    // Rescaled Weibull [version with improved numerical stability]
    // http://mc-stan.org/misc/warnings.html#exception-hamiltonian-proposal-rejected
    y_hat[n] = log( theta[g[n], 1] ) + log1m_exp( - theta[g[n], 2] * pow( x[n], theta[g[n], 3] ) );
  }
}
model {
  // prior distribution for the parameters of the regression predicting population level parameters
  alpha[1] ~ normal( 0, 100 )T[0,]; alpha[2] ~ normal( 0, 100 )T[0,]; alpha[3] ~ normal( 0, 100 )T[0,];
  // prior distribution for community level covariate effects
  beta[1] ~ normal( 0, 100 ); beta[2] ~ normal( 0, 100 ); beta[3] ~ normal( 0, 100 );
  // community level parameters act as priors of species level parameters
  for ( i in 1 : Ng )
  {
    theta[i, 1] ~ normal( mu[1] + theta[1] * zc[i], sigmaa )T[0,]; // prior for species level parameter a
    theta[i, 2] ~ normal( mu[2] + theta[2] * zc[i], sigmab )T[0,]; // prior for species level parameter b
    theta[i, 3] ~ normal( mu[3] + theta[3] * zc[i], sigmak )T[0,]; // prior for species level parameter k
  }

  // data model
  y ~ normal( y_hat, serror );

  // weakly informative priors for scale parameters
  sigmaa ~ cauchy( 0.0, 2.5 );   sigmab ~ cauchy( 0.0, 2.5 );   sigmak ~ cauchy( 0.0, 2.5 );
  serror ~ cauchy( 0.0, 2.5 );
}
generated quantities {
  // pointwise log-likelihoods for WAIC estimation
  vector[N] log_lik;
  for ( n in 1 : N )
  {
    log_lik[n] = normal_lpdf( y[n] | y_hat[n], serror );
  }
}
```