

Multilevel Urban Tree Allometric equations

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Model Comparisons

Short descriptions of the models tested and the brms syntax are in table ??

Note, I removed the scaling of the parameters (multiplying and dividing by 100) in the formula for clarity. In the code they are scaled so that the parameters are on the same order of magnitude and HMC sampling is improved.

Model	Description	brms formula syntax
1	No varying parameters	$DBH \sim b0 + b1 * (1 - \exp(-b2 * AGE^{b3}))$ $b0 \sim 1$ $b1 \sim 1$ $b2 \sim 1$ $b3 \sim 1$
2	Parameters vary by city	$DBH \sim b0 + b1 * (1 - \exp(-b2 * AGE^{b3}))$ $b0 \sim (1 City)$ $b1 \sim (1 City)$ $b2 \sim (1 City)$ $b3 \sim (1 City)$
3	Parameters vary by genus and species Species is nested in genus	$DBH \sim b0 + b1 * (1 - \exp(-b2 * AGE^{b3}))$ $b0 \sim (1 Genus / Species)$ $b1 \sim (1 Genus / Species)$ $b2 \sim (1 Genus / Species)$ $b3 \sim (1 Genus / Species)$
4	Asymptote (β_1) varies by climate	$DBH \sim b0 + b1 * (1 - \exp(-b2 * AGE^{b3}))$ $b0 \sim 1$ $b1 \sim gdd * precip$ $b2 \sim 1$ $b3 \sim 1$
5	Growth rate (β_3) varies by climate	$DBH \sim b0 + b1 * (1 - \exp(-b2 * AGE^{b3}))$ $b0 \sim 1$ $b1 \sim 1$ $b2 \sim 1$ $b3 \sim gdd * precip$
6	Parameters vary by city, genus, and species. Growth rate varies by climate.	$DBH \sim b0 + b1 * (1 - \exp(-b2 * AGE^{b3}))$ $b0 \sim (1 City) + (1 Genus/Species)$ $b1 \sim (1 City) + (1 Genus/Species)$ $b2 \sim (1 City) + (1 Genus/Species)$ $b3 \sim precip * gdd + (1 City) + (1 Genus/Species)$
7	Parameters vary by city, genus, and species (but asymptote does not vary by city). Growth rate varies by climate.	$DBH \sim b0 + b1 * (1 - \exp(-b2 * AGE^{b3}))$ $b0 \sim (1 City) + (1 Genus/Species)$ $b1 \sim (1 Genus/Species)$ $b2 \sim (1 City) + (1 Genus/Species)$ $b3 \sim precip * gdd + (1 City) + (1 Genus/Species)$

Table 1: elpd loo = $\widehat{\text{expected log pointwise predictive density}}$

	Model	$\widehat{elpd}_{\text{loo}}$	elpd diff	elpd loo	se elpd loo
Best	6	-18845.41	0.00	-18845.41	95.85
	7	-18976.38	-130.97	-18976.38	93.66
	3	-18989.24	-143.83	-18989.24	94.11
	2	-19764.48	-919.06	-19764.48	88.69
	5	-20180.41	-1334.99	-20180.41	82.75
	4	-20195.21	-1349.80	-20195.21	82.60
Worst	1	-20513.12	-1667.70	-20513.12	81.57