# Multilevel Urban Tree Allometric equations

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## Model Comparisons

Short descriptions of the models tested and the brms sytax 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 | DBH $\sim$ b0 + b1 * (1 - exp(-b2 * AGE$^{b3}$)) |
| | Species is nested in genus | b0 $\sim$ (1 \| Genus / Species) |
| | | b1 $\sim$ (1 \| Genus / Species) |
| | | b2 $\sim$ (1 \| Genus / Species) |
| | | b3 $\sim$ (1 \| Genus / Species) |
| 4 | Asympotote ($\beta_1$) 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 ($\beta_3$) 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. | DBH $\sim$ b0 + b1 * (1 - exp(-b2 * AGE$^{b3}$)) |
| | Growth rate varies by climate. | b0 $\sim$ (1 \| City) + (1 \| Genus/Species) |
| | | b1 $\sim$ (1 \| City) + (1 \| Genus/Species) |
| | | b2 $\sim$ (1 \| City) + (1 \| Genus/Species) |

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res[[2]]
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| | elpd_diff | elpd_loo | se_elpd_loo | p_loo | se_p_loo | looic | se_looic |
|---|---|---|---|---|---|---|---|
| model6 | 0.0 | -18845.4 | 95.9 | 163.6 | 14.5 | 37690.8 | 191.7 |
| model7 | -131.0 | -18976.4 | 93.7 | 142.4 | 9.7 | 37952.8 | 187.3 |
| model3 | -143.8 | -18989.2 | 94.1 | 185.8 | 12.2 | 37978.5 | 188.2 |
| model2 | -919.1 | -19764.5 | 88.7 | 47.6 | 3.8 | 39529.0 | 177.4 |
| model5 | -1335.0 | -20180.4 | 82.8 | 6.8 | 0.3 | 40360.8 | 165.5 |
| model4 | -1349.8 | -20195.2 | 82.6 | 7.0 | 0.3 | 40390.4 | 165.2 |
| model1 | -1667.7 | -20513.1 | 81.6 | 4.9 | 0.2 | 41026.2 | 163.1 |

Model