

## **Tree growth as it varies with size: how diverse are growth rates of species in one tropical community?**

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Tropical forests are very diverse in terms of species richness, but how diverse are they in functional types or guilds? I examine here variation in one key demographic feature that defines tree guilds: growth pattern as a function of dbh. I used data from 4 censuses of the 50 ha census plot at Barro Colorado in Panama. In nearly all of the 20 common species which I examined in detail, annual dbh increment increased with tree size, from saplings of 10 mm dbh to trees of 200 mm dbh, then it leveled off over a wide dbh range. The consistency of this pattern suggested a simple way to characterize species: with the initial growth rate (at 10-19 mm dbh) and the plateau growth rate (at 200-499 mm dbh). When plotted in the two-space of these parameters, 89 species were spread over a continuum, with no discrete groups discernible. Most species fell in a tight clump, with growth <1 mm/yr as saplings and 3-5 mm/yr as trees. Well known pioneer species had higher than average sapling growth but were average as large trees. Several well-known shade tolerant species had high growth (15 mm/yr) as large trees, but average growth as saplings.

Relative growth rate,  $RGR = (\ln dbh_1 - \ln dbh_2) / time$ , was more amenable to modeling, and I fit it with a double allometric function  $RGR = a_1 dbh^{b_1} - a_2 dbh^{b_2}$ . The first term represents photosynthesis, the second respiration. The scaling coefficient ( $b_1$ ) for total photosynthesis can be derived on first principles from canopy structure and allometric data on tree height and canopy area. Parameter fits from the model can thus provide estimates of scaling coefficients for biomass and respiration. However, in most species the double allometric model collapsed to a single term, with the second term going to zero, and this makes interpretation more difficult. Adding more physiological realism to the model may offer a way to characterize tree growth with physiologically meaningful parameters.

Tropical forest trees encompass a wide range of growth rates, however, the majority of species are very similar, with growth < 1 mm/yr as saplings and 3-5 mm/yr as large trees. Species diversity thus exceeds growth-pattern diversity.