

Buildings as Species: Competition and Scaling Rules in Cities

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We look at the competition between buildings over space in cities through the lens of ecology. Borrowing from its semantics we reveal different predation rules governing the spatial distribution of their sizes seen as species contending over expanse. Multiple definitions of species were tested, when the data were available, including the year of construction, height, volume, and footprint perimeter. The latter yielded parallels to forest trees' competitions, which we expounded on. The buildings' perimeter distribution $p(r)$ exhibits a power-law behavior beyond a critical threshold of the density of the built environment. Within the power-law regime, and based on the species coexistence likelihood $p(d|r)$, we uncover two predation laws depending on the scaling exponent of $p(r)$. More generally, vicious predatory rules are linked to unrestrained growing cities compared to planned, ordered and near-crystalline ones, which we distinguish through a measure of city texture, buildings' orientation entropy, and density for around 1,500 cities in the US.

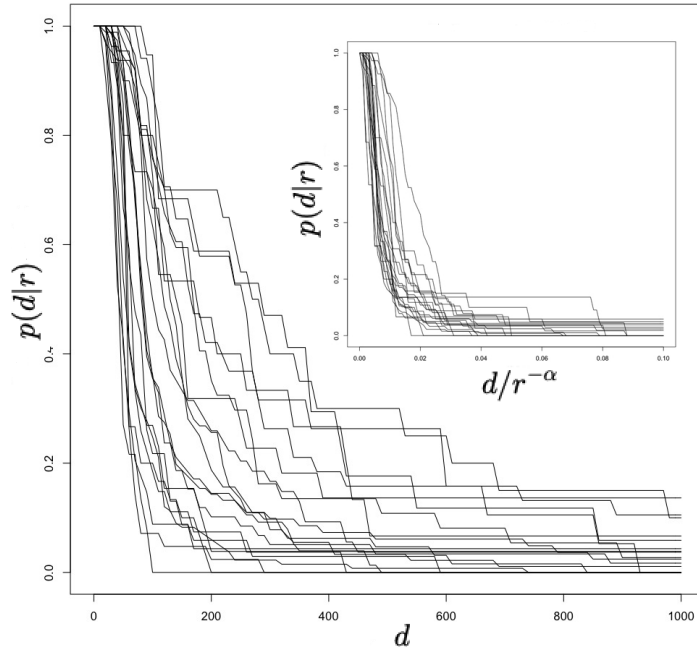


Figure 1: The collapse of the conditional probability distribution of a building's competitor, defined to be the a buildings with a bigger size.