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Over-interpreting forest tree size distributions

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Scientific inferences are limited by the nature of, not only the amount of, data available. Understanding dynamic processes almost always requires dynamic data, especially in forest ecology, where many factors come into play and variation is ubiquitous. LaManna et al. (1) claim to present evidence for higher "conspecific negative density dependence (CNDD)" in tropical than in temperature forests. They regress the density of trees below a threshold size ("saplings") on the density above this size ("adults") and call the slope CNDD. They then show that this slope is steeper in tropical than in temperate forests, and conclude that intraspecific competition is stronger in the tropics.

As we recently argued (2), competition (density dependence) is a process, which, like all processes or rates, can only be measured with dynamic data, in this case by measuring the change in plant size or abundance from one point in time period to another. LaManna et al. state that they have analyzed the sapling data using a Ricker model, but this is a difference equation model, which requires time-series data (3). Treating the number of saplings as a proxy for the next generation of adults entails unjustifiable assumptions. At best, the number of sapling sets an upper limit on the next generation of adults, as most saplings will die due to density-dependent mortality before reaching adulthood. Their interpretation of the data is like considering an age distribution to be a survivorship curve.

Therefore, LaManna et al.'s hypothesis is one among many with which their data are consistent, and this makes their inferences very weak (4). Comita (5) presents one alternative hypothesis in her commentary. There are numerous others, based on factors such as differences in shade tolerance or rates of ecological succession. It is also possible that the pattern they document is a result of, rather than a cause of, increased diversity in the tropics.

1. J. A. LaManna et al., Science 356, 1389 (2017).
2. C. Damgaard, J. Weiner, Trends in Ecology & Evolution 32, 86 (2017).
3. Å. Brännström, D. J. T. Sumpter, Proceedings of the Royal Society B: Biological Sciences 272, 2065 (2005).
4. J. R. Platt, Science 146, 347 (1964).
5. L. S. Comita, Science 356, 1328 (2017).