Ecological genomics of niche exploitation and individual performance in tropical forest trees

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CHALLENGES IN TROPICAL ECOLOGY AND CONSERVATION - GLOBAL PERSPECTIVES

TREE REACTION TO DROUGHT IN A MONTANE RAINFOREST IN SOUTHERN ECUADOR

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The eastern declivity of the Cordillera Real in southern Ecuador is covered by a highly diverse mountain rainforest. Local climate is humid with around 2200 mm of annual rainfall, and dry spells are rather rare but nevertheless a regular event during the "Veranillo del Niño" (VdN) periods in October or November (Volland-Voigt *et al.* 2011). However, different tree species might respond diverse to occasional drought stress, raising the question if some species might be better adapted to a higher frequency of dry periods that may occur under future climate conditions.

We monitored 43 individuals of eight different families with high-resolution electronic dendrometers and analyzed tree responses during dry intervals with a minimum length of four consecutive days without rainfall during July 2007 to November 2010, and additionally during March 2015 to March 2017. We calculated the averaged stem shrinkage rates during these periods, and compared the specific recovery times in consideration of plant families and plant functional types.

Our results showed that the two deciduous broadleaved species *Cedrela montana* and *Tabebuia chrysantha* showed the biggest loss of increment during dry spells, with up to 2 mm stem shrinkage after 10 days of drought. However, the two species differ strongly regarding growth rate and averaged daily increment change with +0.046 mm and +0.016 mm respectively. Looking at the recovery time, *Vismia tomentosa* and *Tapirira guianensis* moved into focus. While *Vismia* recovered to the pre-drought circumference after only five days, *Tapirira* needed 52 days on average to restore its circumference. If such dry spells change in duration and frequency, this may result in an alteration of the forest composition.

ECOLOGICAL GENOMICS OF NICHE EXPLOITATION AND INDIVIDUAL PERFORMANCE IN TROPICAL FOREST TREES

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Understanding characteristics, causes and consequences of biodiversity is a fundamental challenge in ecology and evolution. Biodiversity presents three nested levels, from individuals, over species, to ecosystems.
Intraspecific variability affects the individual level of biodiversity. High levels of intraspecific variability, notably in ecologically important traits has been reported. Intraspecific variability is shaped by the interaction between (1) genetic variability, (2) environmental heterogeneity and (3) stochastic factors.
However, we still know little about the effects of this variability on population dynamics, species interactions and ecosystem processes. Interestingly though, variability at the level of genotypes and traits has been suggested to promote local adaptation of populations and to promote species coexistence at the community level, thus suggesting a role for this variability in the origin and maintenance of biodiversity.
We here present the conceptual framework of the recently started PhD thesis of S. Schmitt. The main objective of the thesis is to further explore the genotype-environment interactions in shaping the intraspecific trait variability of biodiversity. The study site for the thesis is the lowland rainforest in the research station of Paracou, French Guiana, where detailed inventory and tree growth data, as well as environmental characterization are available. We specifically wish to consider the intraspecific genomic variability as a continuum within structured populations of closely related species, and measure its role on individual tree performance through growth over time, while accounting for effects of a finely-characterized environment at the abiotic and biotic level. Eventually, we expect to help building a theory of community ecology starting with individuals, because interactions with environment is based at the individual level.