Seedling survival models in 10 years interval

We modeled the seedling survival for the dry and rainy seasons separately, in order to better understanding the seasonal dynamics of seedling community.

Neighbor densities

Since the effect of adult neighbors on seedling survival is nonlinear in the logistic scale (Detto et al., 2019), we performed a grid-search for the scaling parameter c between 0 and 1 in 0.01 increments that maximized the likelihood of the following survival model,

$$\text{logit}(p_i) = b_0 + b_1 Z_{1i}^c + b_2 Z_{2i}^c$$

where p_i is the individual survival probability in the ith census interval, and Z_1 and Z_2 are distance-weighted sums of basal areas of conspecifics and heterospecifics respectively. We found that c = xx is the best parameter for our dataset.

We then build Bayesian hierarchical models. First, we modeled the survival of tree seedlings at individual-level. Survival of seedling *i* of individual *m* for species *j* in census *t* in plot *p* was modeled using the Bernoulli distribution (B) :

$$s_{i,j,t,p} \sim B(p_{i,j}) + \phi_p + \omega_t + \psi_m$$

$$\text{logit}(p_{i,j}) = \sum_{k=1}^{11} \beta_{j,k} z_{j,k}$$

(need to check j k of z)

where β_k is the vector of species-level coefficients, z_k is the explanatory variables, ϕ_p is the random effect for seedling plots, ω_t is the random effect for different census, and ψ_m is the random effect for the repeated observations of the same individuals. The set of explanatory variables ($z_{j,k}$) includes intercept, log of seedling heights, rain, densities of conspecific (CONS) and heterospecific (HETS) seedlings, densities of conspecific (CONA) and heterospecific (HETA) adult trees that are scaled by XXX, and the interactions of rains with CONS, with HETS, with CONA and with HETA.

In the species-level regression, β was model as:

$$\beta_{j,k} \sim MVN(\sum_{m}^{10?} \gamma x, \Sigma)$$

References

Detto, M., M. D. Visser, S. J. Wright, and S. W. Pacala. 2019. Bias in the detection of negative density dependence in plant communities. *Ecology Letters* 22: 1923–1939.