Public Abstract

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Savannas are spatially diverse, variable and susceptible to high rates of disturbance from fire and herbivory. There is a significant amount of interest in woody species dynamics in relation to disturbance regimes but less effort has been devoted to understanding the processes that drive tree community composition in these systems. Most empirical studies examining the drivers of savanna tree structure tend to focus almost exclusively on recruitment and survival processes between seedlings and/or mature trees, and less emphasis is placed on the role played by seeds. The seed stage suffers limitations such as production, infestation, viability, germination and dispersal. It is not clear how these limitations are influenced by rainfall and what role they play in species composition turnover.

The objectives of this study were 1) Assess species compositional change across multiple environmental gradients, 2) test whether species turnover start at the seed stage and 3) assess the influence of long term rainfall gradient on seed limitation (bottlenecks).

I used tree species composition data collected at the landscape scale in the Serengeti ecosystem to identify the key environmental factors driving variation in tree composition. The potential drivers included in this study were Annual mean precipitation (MAP), soil conditions, herbivory by elephants, slope and fire frequency. I also quantified seed bottlenecks such as production, infestation rates, viability, dispersal and germination rates for two dominant tree species, Acacia tortilis and Acacia robusta and analyzed for their relationship with MAP in two seasons – 2013 and 2014.

My results suggest that tree community composition is largely driven by MAP variability and to a lesser extent associated with elephant population density. I also found that Acacia tortilis tree dominates the dry end of the ecosystem and Acacia robusta the wet end. Surprisingly, fire showed no significant effect on species composition. On seed production Acacia robusta produced more pods compared to Acacia tortilis. Model selection results showed that the proportion of trees producing seeds increased with tree height, but did not differ between species. Infestation rates differed between species within years, but reversed in order from 2013 to 2014, thereby showing no consistent pattern. Seed viability under laboratory conditions were higher in Acacia tortilis than in Acacia robusta and strongly reduced by insect infestation. Against expectations, infestation did not completely inhibit germination.

In general, none of these processes varied across the rainfall gradient, with one exception: Seed viability in Acacia robusta was positively related to site MAP, suggesting that germination potential increases with rainfall. These results provide only weak support for rainfall-mediated effects on seed limitation for observed species turnover across the Serengeti rainfall gradient in adult trees, suggesting that post-germination filters may be more important. These results add more understanding on the dynamics of savanna ecosystem and their drivers. Also these results will be helpful in restoration ecology as they show how different bottlenecks in savanna affect tree recruitment.